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INCLUDING  
ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND  
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY  
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VOL. XVIII.—NINTH SERIES.  
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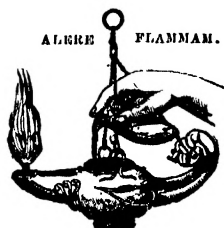
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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportiono, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. . . . . The sylvan powers  
Obey our summons; from their deepest dells  
The Dryads come, and throw their garlands  
And odorous branches at our feet; the Nymphs  
That press with nimble step the mountain-thyme  
And purple heath-flower come not empty-handed,  
But scatter round ten thousand forms minute  
Of velvet moss or lichen, torn from rock  
Or rifted oak or cavern deep: the Naiads too  
Quit their loved native stream, from whose smooth face  
They crop the lily, and each sedge and rush  
That drinks the rippling tide: the frozen poles,  
Where peril waits the bold adventurer's tread,  
The burning sands of Borneo and Cayenne,  
All, all to us unlock their secret stores  
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



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# THE ANNALS

AND

## MAGAZINE OF NATURAL HISTORY.

[NINTH SERIES.]

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“ ..... .. per litora spargite muscum,  
 Naiades, et circum vitreos considite fontes.  
 Pollice virgineo teneros hic carpite flores.  
 Floribus et pictum, divæ, replete canistrum.  
 At vos, o Nymphæ Craterides, ite sub undas  
 Ite, recurvato variata corallia trunco  
 Vellite muscosis e rupibus, et mihi conchas  
 Ferte, Deæ pelagi, et pingui conchylia succo.”  
*N. Partheni Giannettast, Ecl. 1.*

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No. 103. JULY 1926.

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### I.—*Some new Curculionidæ from New Zealand (Col.).*

By GUY A. K. MARSHALL, C.M.G., D.Sc., F.R.S.

[Plate I.]

IN an interesting collection of Coleoptera received during the past three years from Mr. G. V. Hudson, of Wellington, New Zealand, several new species of weevils have been found, and these are described below. The types will all be deposited in the British Museum, which already contains practically all the types of New Zealand Curculionidæ described by White, Pascoe, Sharp, and Broun.

A comparison of a number of these types has revealed a certain amount of synonymy, which is recorded at the end of the paper.

The general arrangement in Mr. Hudson's useful "Index of New Zealand Beetles" (Trans. N.Z. Inst. liv. pp. 353-399) has been followed, though Broun's classification obviously requires revision in some particulars.

#### Subfamily OTIORRHYNCHINÆ.

*Bryodrassus dentifer*, sp. n. (Pl. I. fig. 5.)

♂. Integument black or piceous; the head and rostrum

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with dense grey scaling, the former mottled with fulvous; the prothorax grey, with indefinite, but symmetrical, dark markings on the dorsum and two dark stripes on the pleuræ; the elytra with the greater part of the dorsum dark brown, the suture and the postmedian areas on intervals 3-5 fulvous, intervals 6 and 7 mostly grey, an irregular narrow grey band across the top of the declivity, and some irregular grey spots along stria 1 behind the middle. The markings will probably prove to be variable.

*Head* even, with the sculpture entirely hidden by the scaling and recumbent setæ; the forehead strongly convex transversely. *Rostrum* somewhat longer than broad, slightly narrowed from the base to the middle and dilated in the apical half; the dorsal area parallel-sided, slightly convex transversely, with a narrow median carina, which is for the most part covered with dense suberect scaling, the setæ stout and erect; the inter-antennal area shallowly impressed and with scattered granules, the posterior margin of the epistome rounded. *Antennæ* with the scape squamose and set with narrow suberect setæ; the funicle with joint 1 longer than 2, 3 slightly longer than broad, the remainder missing in the type. *Prothorax* as long as broad, strongly rounded at the sides, widest before the middle, with a shallow constriction at the apex, which is continued more broadly across the dorsum; the apex rather more than half the width of the base, feebly arcuate dorsally, with the post-ocular lobes moderate, the base arcuate; the dorsum gently convex longitudinally and somewhat flattened transversely, bearing down the middle of the disk numerous shiny granules each carrying a curved spatulate seta, the granules on the lateral areas much smaller and mostly hidden by the dense scaling; the pleuræ with coarse bare punctures. *Scutellum* small, bare, shining. *Elytra* jointly sinuate at the base, which is as broad as the widest part of the prothorax, thence widening for a short distance (owing to a subhumeral prominence), then gradually narrowed to the declivity and there angularly constricted, the apices being jointly rounded; the dorsum quite flat longitudinally to the declivity and flattened transversely as far as interval 5, the declivity being very steep and its summit irregularly subangulate transversely; the striæ shallow and containing deep round separated punctures not covered by scaling, striæ 1-3 curving outwards at the base; the intervals much broader than the striæ, flattened or slightly convex, the alternate ones very slightly more raised, and all densely covered with overlapping fluted scales (smaller than those

on the pronotum) and with irregular rows of subrecumbent spatulate setæ, interval 5 with an obtusely angulate prominence on the declivity. *Legs* with the front femora somewhat inflated, thicker than the others, straight on the ventral surface and strongly arched above; the front tibiæ broadly flattened and shiny on the inner face in the apical half, the hind tibiæ with a stout tooth at the middle of the inner face. *Underside*: the mesosternal process subquadrate, clothed with fine hairs, and with its anterior edge produced into a stout sharp oblique tooth; the median area of the metasternum and venter devoid of scaling, rugosely granular, and clothed with fine long subrecumbent hairs.

*Length* 6.6 mm., *breadth* 2.7 mm.

NEW ZEALAND.

This remarkable insect is represented by only a single ♂, in Pascoe's collection. The only other known species of the genus, *B. miricollis*, Brn., 1917, differs in being much more convex transversely; the prothorax is broader than long, transversely striolate, and without granules; the elytra have the alternate intervals distinctly raised, there is no transverse angulation across the top of the declivity, nor any prominence on interval 5, but there is a low callus on each side near the apex; the front tibiæ are not flattened internally, but bear a sparse fringe of long hairs, and the hind pair have no tooth; the mesosternal process is strongly transverse, densely squamose, broadly truncate in front, and without any projecting tooth; and the metasternum and venter are densely squamose throughout. All the three examples known to me are males.

*Inophlæus turricola*, sp. n. (Pl. I. fig. 3.)

♀. *Integument* dull black, uniformly clothed with narrowly separated small blackish scales.

*Head* with close shallow punctation, each puncture hidden by a scale, and a few scattered deeper setigerous punctures; the forehead strongly convex transversely, separated from the rostrum by a slight depression, with a small median fovea and a few short suberect setæ towards the sides. *Rostrum* shorter than the pronotum, gradually narrowed from the base to the middle and thence strongly dilated to the apex; the dorsal area with its lateral margins not carinate but rounded off, gradually narrowing from the base to beyond the middle then widening to the antennæ, punctured like the head and with a smooth bare median carina; the interantennal area shallowly impressed, the epistome somewhat elevated, but its margins ill-defined and

not carinate. *Antennæ* with the scape thinly clothed with fine hairs and subrecumbent setæ; the joints of the funicle in order of length: 1, 2, 3, 4, (5, 6, 7), the distal joints bead-like and only slightly longer than broad; the club rather broadly elliptical. *Prothorax* transverse, strongly rounded at the sides, widest at the middle, and shallowly constricted near the apex; the postocular lobes rather feeble, the base truncate and obtusely marginate; the dorsum quite smooth and punctured like the head; the setæ inconspicuous, very short, and recumbent. *Scutellum* comparatively large, trapezoidal. *Elytra* ovate, somewhat flattened on the disk, and with two sharp divergent processes at the apex; the striæ distinct and strongly punctate, 1 and 2 uniting at the base, also 3 and 4; the intervals much wider than the striæ, flat or slightly convex and smooth, interval 3 with a low obtuse setose prominence at the top of the declivity, which is very steep, and interval 1 somewhat raised on the declivity and there set with suberect pale setæ; irregular short recumbent pale setæ are also present throughout intervals 3, 5, 7, and longer erect ones on the apical margin and processes. *Legs* black, the tibiæ and tarsi red-brown, with grey scaling and subrecumbent pale setæ.

*Length* (including apical processes) 9 mm., breadth 3.6 mm.

NEW ZEALAND: Minaret Peaks, 6000 ft., Lake Wanaka, 1 ♀, 29. xii. 1923 (*C. E. Clarke*).

Very similar in size and general facies to *P. tricoatus*, Brn., but in that species the dorsal margins of the rostrum are carinate; the distal joints of the antennæ are clavate and not bead-like, and the club is much narrower; the elytra are not flattened on the disk, the alternate intervals are slightly raised, and there is an obtuse angular prominence on the suture at the top of the declivity, but none on interval 3.

#### Subfamily RHYPAROSOMINÆ.

*Phygotharpus sulcipennis*, Brown, 1915. (Pl. I. fig. 6.)

A male *Phygotharpus*, forwarded by Mr. Hudson and taken on the Old Mau Range, Otago, iv. 1920 (*G. Howe*), was at first thought to be an undescribed species, but it seems more probable that it is the previously unknown male of *P. sulcipennis*, Brn.

The elytra are much narrower and less rounded laterally than in the ♀ type; the prothorax is proportionately longer, and the median furrow is broader and shallower and extends

backwards almost to the base. The ♀ has a short smooth ridge on the head, just behind the frontal fovea, which is lacking in the ♂; but this is probably an individual variation.

*Rystheus fulvosetosus*, sp. n. (Pl. I. fig. 1.)

♂. Dull black, with tufts and patches of fulvous setæ.

*Head* conical, as seen from above, with a few large shallow punctures dorsally and a very deep frontal fovea; the forehead in exactly the same plane longitudinally with the vertex, strongly convex transversely, and set with coarse transverse subrecumbent fulvous setæ; the eyes not projecting, their contour being absolutely continuous with that of the head. *Rostrum* a little longer than the pronotum, stout, strongly curved, rapidly narrowing for a short distance from the base, thence subcylindrical to the antennæ (inserted at about one-fourth from the apex), the apical portion being much wider and parallel-sided; the dorsum tricarinate, the median carina being higher, the interspaces obsoletely punctate, and the outer carinæ slightly convergent and sparsely punctate anteriorly; the lateral areas coarsely and shallowly punctate, and with an indefinite sinuous carina, all the punctures containing a minute seta; the apical area with shallow strong separated punctures. *Antennæ* with the scape strongly and abruptly clavate; the funicle with joint 2 slightly longer than 1, the remainder subequal and slightly transverse. *Prothorax* about as long as broad, moderately rounded at the sides, broadest at about the middle, not constricted in front, and much narrower at the apex than at the base, which is truncate; the dorsum even, with large shallow separated punctures, each containing a short adpressed seta, and with an indistinct broad median furrow, which becomes broader and much deeper at the base; the whole surface opaque and shagreened, with a few scattered shiny dots. *Elytra* subconical, widest at the apex, not broader than the prothorax at the base and gradually widening posteriorly, with the sides almost straight, and appearing broadly truncate behind owing to the declivity being abruptly perpendicular, the actual apex truncate; the lateral areas perpendicularly declivous beyond interval 5, and shallowly excavated below stria 6; the dorsum only moderately convex transversely, the longitudinal outline rising rapidly from the base to before the middle and then sloping gently to the top of the declivity; the striæ very shallow, quite regular, and containing shallow distant punctures, each

having a fulvous seta lying across it; the intervals finely shagreened and with scattered small obsolescent shiny granules, interval 2 shallowly depressed throughout and more deeply so at the base, so that 1 and 3 appear slightly raised, 1 not depressed at the base, 3 with a low callus at the base and a large angular prominence at the top of the declivity; interval 1 with a stripe of recumbent fulvous setæ from before the middle to the apex, 3 and 5 with dense subrecumbent separated tufts of setæ; the declivity subcordiform, rather densely clothed with long recumbent fulvous setæ, almost flat, but with the suture obtusely elevated on the upper half. *Legs* black, with sparse recumbent setæ and scattered depressed shining granules; the tarsi piceous, with joint 3 only slightly broader than 1 and 2.

*Length* 7·8 mm., *breadth* 2·7 mm.

NEW ZEALAND: Waiho Gorge, 1 ♂, 14. i. 1925 (*C. E. Clarke*).

This insect is much larger than either of the two previously described species, and differs from them also in the complete absence of granulate tubercles, in the tufts of fulvous setæ on the elytra, and the strong lateral dilatations of the posterior declivity.

*Rystheus hudsoni*, sp. n. (Pl. I. fig. 2.)

♀. Piceous-black, opaque, with sparse adpressed fulvous setæ.

*Head* shagreened and with obsolescent granules; the forehead transversely flattened and forming a slight angle with the vertex, with a large deep median fovea and without evident setæ; the eyes slightly convex. *Rostrum* a little longer than the pronotum, strongly curved, rapidly narrowing at the immediate base, thence cylindrical to the antennæ, and then gradually widening to the apex, rather strongly but shallowly punctate in irregular rows as far as the antennæ (inserted at one-third from the apex), the smooth interspaces scarcely carinate, the apical area with fine scattered punctures; no setæ. *Antennæ* with the scape having a small abrupt club; the funicle with joints 1 and 2 equal, 3-6 subequal and quadrate, 7 distinctly longer and widening from base to apex. *Prothorax* about as long as broad, only slightly rounded at the sides, widest before the middle and narrowed at the apex, the base truncate; the dorsum uneven, rugosely punctate and the intervals bearing indefinite granules, with two low rounded ill-defined granular calli in the middle of the disk and an oblique impression behind each,

and with a large and very deep fovea in the middle of the base; a few sparse short recumbent setæ; the pleuræ coarsely punctate, but with very few granules. *Elytra* subcylindrical, not wider than the prothorax at the base (the outline of the sides being practically continuous), broadly truncate behind owing to the declivity being abruptly perpendicular, very slightly rounded at the sides, widest well behind the middle, and strongly convex transversely, the longitudinal outline gently convex and rising from the base to the top of the declivity; the dorsum with the striæ very irregular and containing indefinite shallow punctures, the intervals with irregularly scattered shining granules, agglomerated here and there into low rounded tubercles, and with two large obtusely-conical granulate vertical prominences at the top of the declivity on each side of the suture; the perpendicular lateral areas with regular rows of remote shallow punctures, the two upper intervals alone bearing each a row of small flattened shiny granules; the declivity subcordate, but not nearly so widely dilated laterally in its upper half as in *R. fulvosetosus*, rather thinly clothed with recumbent fulvous setæ, transversely convex, the suture being raised and irregularly granulate, and with a few scattered granules elsewhere; the setæ on the dorsum shorter and much more sparse than those on the declivity. *Legs* piceous-brown, with the tarsi paler; the femora opaque, with rather conspicuous shiny granules and sparse pale recumbent setæ; the tibiæ scarcely granulate; the tarsi with the two basal joints distinctly narrower than the third.

*Length* 5.1 mm., *breadth* 1.8 mm.

NEW ZEALAND: Mt. Egmont, 4000 ft., 1 ♀, i. 1923 (G. V. Hudson).

Nearly allied to *R. notabilis*, Brn., 1917, which differs in having the median basal fovea on the pronotum smaller (much smaller than the corresponding depression on the elytra, whereas in *R. hudsoni* these are nearly equal), the surface of the pronotum being less strongly granulate, and the setæ near the apical margin stouter and more dense; on the elytra the punctures are rather more regular, and the elevations at the top of the declivity are higher, more acuminate, and project backwards so as almost to conceal the declivity from above, whereas in *R. hudsoni* they are vertically truncate behind.

#### Subfamily ERIRRHININÆ.

*Eugnomus robustus*, sp. n. (Pl. I. fig. 4.)

♂. Integument cinnaumon-brown, the head and prothorax



rather darker, the vertex of the head and the scutellum blackish; the prothorax on each side with a broad stripe of whitish scales which is wider in the posterior half, sharply defined on its inner edge, and less definite and broadly sinuate on its outer edge; the elytra with the apical area covered with greyish-white scales, and similar scales are sparsely and irregularly scattered along intervals 7 and 8; a dense patch of pale scales on the anterior half of the metepisternum, and the prosternum, metasternum, and the sides of the venter are more thinly covered with similar scales.

*Head* dilated from the eyes to the base, rugosely and confluent punctate throughout; the forehead quite flat and on a level with the dorsal outline of the eyes, without any median fovea; the setæ recumbent on the vertex and sides, erect and suberect on the anterior portion and the forehead; a ring of sparse pale scales round the eyes, which are moderately prominent. *Rostrum* as long as the pronotum, gradually narrowed from the base to the middle, thence widening to the apex, which is as broad as the base; the sculpture like that of the head, with a well-marked median carina from near the base to beyond the antennæ, which is divided by a longitudinal furrow in its anterior half, and a short sharp carina on each side from the middle to the antennæ; the apical portion with a median triangular flattened coriaceous area; the scrobes rapidly passing beneath the rostrum but still visible in exact profile right to the base. *Antennæ* with joint 1 of the funicle as long as 2+3, 3 and 4 a little longer than broad and subequal, 5-7 transverse and subequal; the club elongate, joints 1 and 2 together much shorter than the remainder. *Prothorax* broader than long, campanulate, widest at the base, narrowing very gradually (and with the sides almost straight) to beyond the middle, then rapidly and roundly narrowing to the very deep apical constriction, which is shallowly continued across the dorsum, the truncate apical margin being somewhat raised and the base feebly arcuate; the dorsum flat longitudinally, closely and confluent punctate throughout, with a very shallow large rounded impression on each side; with scattered short erect setæ throughout and longer ones on the apical margin, the non-squamose median area with rather dense recumbent forwardly-directed golden setæ. *Scutellum* broadly ovate, rugulose punctate and sparsely setose. *Elytra* broadly ovate, parallel-sided from the roundly rectangular shoulders to beyond the middle, with the posterior calli obtusely indicated, and with a shallow

oblique depression at one-fourth from the base between striæ 1 and 4, the basal area on intervals 2-4 forming a low obtuse elevation; the narrow striæ containing fine close shallow punctures, the septa between them being shiny and subgranulate; the intervals broad, slightly convex, with fine close rugulose punctation (making the surface opaque) and fairly densely clothed with short recumbent golden setæ, there being a small tuft of suberect darker setæ behind the middle on interval 2. *Legs* concolorous; the femora clothed with suberect setæ and scattered pale scales.

*Length* 7 mm., *breadth* 3 mm.

NEW ZEALAND: Mt. Arthur, 4300 ft., 9. i. 1925, 1 ♂, on flowers of speargrass (*G. V. Hudson*).

This insect is much larger than any other known species of the genus. Its nearest allies are *E. fervidus*, Pasc., and *E. nubilans*, Brn., but both these species differ from it, *inter alia*, in the following characters: the rostrum is not carinate; the forehead is depressed below the dorsal level of the eyes; the apical portion of the antennal club is not longer than the two basal joints together; the apical constriction of the prothorax is shallow; the entire sides of the prothorax, the metepisternum, and the scutellum are densely squamose; the elytra lack the tuft of setæ on interval 2; and the femora are devoid of scaling.

#### DORYTOMODES, gen. nov.

The numerous New Zealand species (18) referred by Broun to the genus *Dorytomus*, Steph., 1831, cannot satisfactorily be retained there, owing to the fact that they all possess strongly appendiculate tarsal claws, whereas the true *Dorytomus* have simple claws. They are, therefore, here transferred to a new genus, with *Dorytomus aciphyllæ*, Bru. (Pl. I. fig. 7), as the genotype.

A similar difficulty arises in connection with the 53 New Zealand species assigned to *Erirrhinus*, Schh., 1826. The species of this purely Palæarctic genus, besides presenting a quite distinctive facies, have the tarsal claws simple and the posterior angles of the intermediate ventrites truncate, while the intercoxal process of the venter is narrowly ogival and, at its middle, not more than half the width of the adjoining coxa. On the other hand, in the New Zealand species the claws are appendiculate, the posterior angles of the intermediate ventrites are slightly produced backwards, and the intercoxal process of the venter is broadly arcuate, being much broader than half the adjoining coxa.

These latter characters are, however, also to be found in *Dorytomodes*, and I have failed to discover the distinctions upon which Broun relied for the separation of his genera *Erirrhinus* and *Dorytomus*. In his definitions the only tangible distinction given is that the former has simple and the latter toothed femora; but it will be found that he has himself described various species under *Erirrhinus* that have more or less distinctly toothed femora, while his *Dorytomus aciphyllæ* has the femora toothed in the ♂ and simple in the ♀. This character cannot therefore be here regarded as of generic value, and *Erirrhinus*, Broun (nec Schlh.), must provisionally be merged in *Dorytomodes*.

*Dorytomodes pardalis*, sp. n.

♂. Integument pale testaceous-brown; the pronotum with a median dark brown stripe that reaches neither base nor apex and an ill-defined one on the pleuræ; the elytra with a large common triangular basal patch (extending to stria 5 at the base), the suture and the lateral margins pale testaceous-brown, the remainder whitish testaceous with numerous irregular, more or less contiguous, blackish spots; the legs testaceous-yellow; the metasternum dark brown.

*Head* with fairly dense scalo-like subrecumbent setæ. *Rostrum* a little shorter than the head and pronotum, gently curved, slightly widened beyond the antennæ, with comparatively coarse confluent punctation and a fine median carina; the setæ very short, transverse, and recumbent on the dorsum, much longer and obliquely raised beneath; the scrobes passing beneath the rostrum in the basal half. *Antennæ* with the scape and first funicular joint testaceous-yellow, the remainder brown. *Prothorax* transverse (2:3), strongly rounded at the sides, widest a little before the middle, and shallowly constricted at the apex, the constriction being continued across the dorsum, which is closely and subconfluently punctate throughout, except for an irregular median line that corresponds with the dark stripe; the whitish setæ stout and transversely recumbent, except for a few isolated erect ones along the apical and lateral margins. *Scutellum* concolorous and with a few setæ. *Elytra* oblong-ovate, subtruncate at the base, with the dorsal outline flat to beyond the middle and the posterior calli distinct; the striæ with strong punctures, which become much reduced behind; the intervals broader than the striæ, shallowly punctate, thinly clothed with short recumbent hairs and set with stiff pointed erect white setæ. *Legs* unicolorous; the femora

with a stout tooth; the tibiæ with a very short apical mucro.

*Length* 2·6 mm., *breadth* 1·1 mm.

NEW ZEALAND : Pokororo, Nelson, 9. i. 1919, 1 ♂ (*G. V. Hudson*).

The colouring of the elytra is very distinctive; structurally, the most nearly related species is *D. æricomus*, Brn., 1886, which is very similar in size and general facies, but its rostrum is not widened at the apex, the pronotum has no smooth median line, the recumbent hairs on the elytra are longer and denser and scale-like towards the base, and the characteristic stout erect setæ of the new species are entirely lacking.

*Dorytomodes decussatus*, sp. n.

♂ ♀. Integument testaceous-brown, the rostrum and legs much paler; the elytra with a common x-shaped marking of testaceous-yellow, running broadly from the shoulder to before the middle of stria 1 (not reaching the suture), continued for a short distance along intervals 2 and 3, then curving broadly and indefinitely outwards at the top of the declivity; the lower surface dark brown.

*Head* closely and strongly punctate, bare. *Rostrum* as long as the head and pronotum, gently curved, bare; in ♂ with a fine median carina and a shallowly punctate stria on each side of it, and with shallow confluent punctures at the sides; in ♀ with the punctures less evident and the median carina much reduced; the scrobes entirely lateral. *Antennæ* yellow throughout, the club relatively much shorter and broader than usual. *Prothorax* transverse, moderately rounded at the sides, widest a little before the middle, feebly constricted at the apex, the constriction being broadly and shallowly continued across the dorsum, which is strongly and closely punctate, with sometimes a trace of a smooth median line, and sparsely clothed with fine recumbent white setæ. *Elytra* ovate and rather strongly convex transversely, the dorsal outline gently convex and highest before the middle, without posterior calli; the striæ containing strong punctures which scarcely diminish behind; the intervals about as broad as the striæ, gently convex, with very shallow indistinct punctures and sparse short recumbent white hairs, without any erect setæ. *Legs* rather stout, the femora unarmed, the tibiæ without any apical mucro.

*Length* 1·8 mm., *breadth* 0·75 mm.

NEW ZEALAND : Karori, iii. 1924, 1 ♀; Wellington, 1 ♂ (*G. V. Hudson*).

The smallest known species in the genus, and its size together with the characteristic cross-like marking on the elytra should make it easy to recognise. Its nearest allies are *Erirrhinus fusciventris*, Brn., and *E. thomsoni*, Brn.; but both these species differ in having the elytra much broader proportionately, the antennal club is more elongate and darker than the funicle, the rostrum has no narrow median carina, and there is a small sharp tooth on the hind femora and a rudimentary tooth on the other pairs.

Subfamily CRYPTORRHYNCHINÆ.

*Hatasu hudsoni*, sp. n. (Pl. I. fig. 8.)

♂. Integument opaque, black; the head with light brown scaling and two indefinite dark brown branches in the middle; the prothorax thinly clothed above with light brown scaling, with two admedian broad bare black stripes diverging from the base to the middle and two small patches of erect dark brown scales in the middle of the disk, the sides of the dorsum and the whole of the pleuræ being covered with dense whitish scales intermingled with pale brown; the elytra with sparse pale brown scaling, an irregular whitish patch at the basal angles, a narrow irregular transverse whitish band at the top of the declivity extending outwards to interval 7 and covering the apical end of the posterior tubercles on intervals 3, 5, 7, both tubercles on interval 3 and the posterior one on 5 otherwise covered with dark brown scales; the legs with pale brown scaling, the femora with a large whitish dorsal patch near the apex and a much smaller one near the base, the tibiæ with an elongate dark brown dorsal patch in the middle.

*Head* with the scales recumbent at the sides and erect or suberect in the middle of the vertex; the forehead flattened, with a short median stria. *Rostrum* somewhat compressed dorso-ventrally, gently curved, narrowing slightly from the base to the antennæ, then widening again to the apex; the dorsum strongly convex transversely, without furrows or carinæ, in the post-antennal portion opaque and set with small squamigerous punctures, the scales erect and long, except along the median line where they are short and recumbent; the apical area shiny and with strong subconfluent punctation. *Antennæ* with joints of the funicle in order of length: (1, 2,) 3, 4, (5, 6,) 7; 5 and 6 about as long as broad, 7 wider and transverse. *Prothorax* somewhat broader than long, rapidly widening from the base to beyond the middle and then abruptly and sinuately narrowed to the

apex, which is strongly arcuate and only about half as wide as the truncate base; the dorsum less convex transversely than usual and gently convex longitudinally, being highest in the middle, smooth and shagreened, the punctures inconspicuous, each containing a scale; the scales mostly recumbent and subcircular, but a few erect subcylindrical ones scattered over the surface, others forming two tufts in the middle of the disk and two indefinite clusters near the apex. *Elytra* much shorter proportionately than usual, suboctagonal, being about as broad as long and very steeply retuse behind, with the actual apex rather broadly subtruncate; the basal margin truncate, with the lateral angles projecting slightly forwards; the dorsum with rather irregular rows of large deep rounded foveæ; interval 3 with an elongate tubercle before the middle and a larger one behind it; interval 5 with two obtusely subconical tubercles, similarly placed, and two corresponding but less prominent ones on interval 7.

Length 6 mm., breadth 3.5 mm.

NEW ZEALAND: Flora Camp, Mt. Arthur, 2800 ft., 1 ♂, 10. i. 1925 (G. V. Hudson).

Smaller and proportionately much shorter than any of the previously described species of the genus, and differing from them also in its laterally angulate prothorax, steeply declivous elytra, and in the arrangement of the elytral tubercles.

#### Subfamily COSSONINÆ.

##### *Heteropsis latirostris*, sp. n. (Pl. I. fig. 9.)

Piceous-black, shining; the antennæ and legs red-brown, the antennal club and tarsi paler.

*Head* strongly constricted behind the eyes, the vertex with only a few widely scattered punctures; the forehead wider than the base of the rostrum and equal to its greatest width, somewhat flattened in the middle, but sloping steeply downwards to the eyes on each side, with fairly dense separated punctures and a very shallow small median fovea; the eyes very prominent, slightly transverse, and with the posterior margin subtruncate. *Rostrum* as long as broad, strongly rounded at the sides (the dorsal margins projecting laterally with a sharp edge), widest behind the middle, only slightly convex transversely, and sloping steeply in front; the dorsum with small close punctures, which are denser than those on the forehead and become shallower towards the apex, the median area somewhat flattened. *Antennæ* with joint 1 of the funicle equal to 2+3, 2 as long as broad, 3-5 strongly

transverse and equal. *Prothorax* subconical, broadest close to the base, with the posterior angles very broadly rounded, strongly narrowed to the apex, with the sides straight, and deeply constricted near the apex, the constriction being continued across the disk; the dorsum flattened in the middle and rather steeply declivous at the sides, set with small deep punctures, for the most part separated by more than their own diameter, but rather denser in the flattened median area, in the middle of which is a small lanceolate impunctate space; the lateral punctures containing minute recumbent setæ, not easily observed. *Scutellum* punctiform, smooth. *Elytra* oblong-ovate, not broader at the shoulders than the widest part of the prothorax, slightly widened for a short distance from the shoulders to a point where the marginal carina becomes visible from above, and thence parallel-sided to far beyond the middle; the strongly punctate striæ well marked and becoming broader and deeper on the steep apical declivity; the intervals about as broad as the striæ, each bearing a row of minute punctures and with sparse minute recumbent setæ, which are very inconspicuous except near the apex. *Legs* rather opaque, with shallow punctures and fine recumbent setæ; the femora broad and subcompressed.

Length 3.3 mm., breadth 1 mm.

NEW ZEALAND: Campbell's Hill, Karori, 12. ii. 1922 (G. V. Hudson).

The sex of the unique specimen is uncertain.

The only other known species of the genus, *H. lawsoni*, Woll., is a much smaller insect (length 1.8 mm.) and proportionately narrower; the eyes are very small and quite flat; the rostrum is not so broad and scarcely rounded at the sides; the apical constriction of the pronotum is much shallower and not continued across the dorsum; the striæ on the elytra are not deeper behind, etc.

#### NOTES ON SYNONYMY, ETC.

*Tigones (rufula*, Brn., 1893) = *T. binodula*, Shp., 1886.

(*Rhynchogonus germanus*, Brn., 1893) = *Phlyctinus callosus*, Boh., 1834. This species has been introduced into New Zealand from the Cape Province, South Africa, where it is a common vineyard pest.

(*Drymaria*, Brn., 1909) = *Nestrius*, Brn., 1893.

*Catoptes (obliquis*, Brn., 1880, nec Schönh.) = *C. oblique-signatus*, Boh., 1842. There is no such species as *C. obliquis*, Schönh.

*Catoptes (decorus*, Brn., 1893) = *C. scutellaris*, Shp., 1886.

(*Heterodiscus*, Shp., Nov. 1886) = *Echinepeplus*, Brn., 1886.

(*H. horridus*, Shp., Nov. 1886) = *E. dilatatus*, Brn., 1886.

(*Heteromias*, Brn., 1913, nec Fst., 1897) = *Phygotharpus*, Brn., 1915. In describing his later genus Broun evidently overlooked its identity with his *Heteromias*, which he had placed with doubt in another subfamily. Faust's name was omitted from the 'Zoological Record' because he published it without any indication that the genus was new.

*Cuneopterus (tenuicornis*, Brn., 1893) = *C. conicus*, Shp., 1886.

*Clypeorhynchus (ovipennis*, Brn., 1893) = *C. gracilipes*, Shp., 1883.

*Eugnomus (Hoplocneme) cinnamoneus*, White, is an *Oreocharis*.

*Eugnomus (discolor*, Brn., 1880) = *E. fucosus*, Pasc., 1877.

*Eugnomus (cyaneus*, Brn., 1886) = *E. ænescens*, Brn., 1886, ♀, colour variety.

*Eugnomus (tarsalis*, Brn., 1886) = *E. ænescens*, Brn., 1886, ♂.

*Oreocharis (ferruginea*, Brn., 1904) = *O. cinnamonea*, Wht., 1846.

*Oreocharis (dives*, Brn., 1913) = *O. cinnamonea*, Wht., var.

*Scolopterus (æquus*, Brn., 1880) = *S. tetracanthus*, Wht., 1846, aber.

*Icmalius helmsi*, Shp. The reference given in Hudson's Index (p. 394) is erroneous; it should be, Trans. Roy. Dublin Soc. (2) iii., Nov. 1886, p. 452.

*Nyxetes (rufipes*, Brn., 1881) = *N. bidens*, F., var.

*Mesoreda (longula*, Brn., 1913) = *M. orthorhina*, Brn., 1886, ♀.

*Rhyncodes* (Hudson's Index, p. 397) was originally and correctly spelt *Rhynchodes* by White. The erroneous spelling was started by Lacordaire and perpetuated by Broun.

*Agastegnus (sericatus*, Brn., 1886) = *A. simulans*, Shp., 1878, ♂.



(*Diædimorpha*, Brn., 1886) = *Stenotrupis*, Woll., 1873; as already pointed out by Champion (Trans. Linn. Soc. Lond. xvi. 1914, p. 464).

#### EXPLANATION OF PLATE I.

- Fig. 1. *Rystheus fulvosetosus*, sp. n.  
 Fig. 2. — *hudsoni*, sp. n.  
 Fig. 3. *Inophleus turricola*, sp. n.  
 Fig. 4. *Eugnomus robustus*, sp. n.  
 Fig. 5. *Bryodrassus dentifer*, sp. n.  
 Fig. 6. *Phygotholpus sulcipennis*, Brn., ♂.  
 Fig. 7. *Dorytomodes* (gen. nov.) *aciphyllæ*, Brn.  
 Fig. 8. *Halasu hudsoni*, sp. n.  
 Fig. 9. *Heteropsis latirostris*, sp. n.

#### II.—On the Primitive Phyllopodium.

By L. A. BORRADAILE, Sc.D.

Two important memoirs recently published have bearings upon the problem of the configuration of the phyllopodia of the ancestral Crustacean.

Mr. D. J. Scourfield describes (Phil. Trans. B. 214, 1926), from the Rhynie Chert of Aberdeenshire, a remarkable Branchiopod which he has named *Lepidocaris rhyniensis*. This creature, while it has a general, and upon the whole rather close, resemblance to the Anostraca, differs from the members of that group in certain important particulars—in the nature of the antennules and antennæ, the possession by the male of a pair of claspers in the region of the maxillules, the conformation of the telson, and so forth. Its trunk-limbs are of two very distinct types. The first three pairs are phyllopodia, whose plan has a good deal in common with that of the trunk-limbs of the Anostraca, but differs from it in the following respects: (1) The first endite of the Anostraca is replaced by two smaller endites, of which the proximal is a gnathobase much like that of the Conchostraca, and as in the latter group a rudimentary articulation crosses the limb distally to the gnathobase—this seems to confirm my surmise, stated in a paper published in the February number of this Journal, that in the Anostraca a gnathobase has disappeared, and to indicate fusion with the succeeding endite as the mode of its disappearance; (2) the fringe of long bristles upon the first two endites of the phyllopodium of the Anostraca is replaced, save upon the gnathobase, by shorter, sparser, and less regular hairs; (3) the distal endite (which should probably be called the apical lobe), though, as in the Anostraca, it is much larger than

the rest, has a peculiar palmate shape, with long comb-like spines; (4) the articulate distal lobe of the Anostraca, which has been variously regarded as the flabellum (exopodite) and as the apical lobe of the phyllopodium of other Branchiopoda, here betrays itself definitely as the flabellum by its position upon the outer border of the limb, nearly in the normal position of the flabellum; (5) there is no branchia (metepipodite), and no proepipodite unless the large scales at the bases of the limbs be such. The remaining trunk-limbs are of a very different type. In these there is accomplished the formation of a peculiar kind of biramous limb which, as I pointed out in the paper cited above, is incipient in the Anostraca. In that group the articulated distal lobe, which must now be regarded as the flabellum, forms with the apical lobe (last endite)—especially in species in which the latter is directed distally—a pair of rami, of which the outer is truly homologous with the exopodite of other Crustacea, but the inner represents much less of the axis than the normal Crustacean endopodite, since there are five (or, with the missing gnathobase, six) endites proximal to it. In *Lepidocaris* both these structures are articulated, and they form a pair of similar subovate rami. The six endites, including the gnathobase, are retained proximal to these rami.

The discovery of these interesting types of limb brings the rather anomalous trunk-appendages of the Anostraca into line with those of other Branchiopoda, and confirms the view that the primitive phyllopodium possessed a flabellum near the middle of the outer border and a gnathobase.

Further suggestions towards the reconstruction of the phyllopodium of the ancestral Crustacean are made in a brilliant and extraordinarily interesting paper by Storch upon the limbs of Trilobita (*Zeitschr. f. wiss. Zool.* cxxv. 1925). Briefly, Storch puts forward the view that the fringed ramus, which has hitherto been regarded as the exopodite of these limbs, is in reality the endopodite and corresponds to the fringed side of the phyllopodia of Anostraca and Cladocera, while that which has been called the endopodite is the exopodite. Thus he brings the limbs of Trilobita into agreement with those of Branchiopoda, though it would seem that in the Trilobita the flabellum has already undergone that transformation into a slender jointed member which it has (probably independently) achieved in various non-phyllopod groups.

Storch agrees with Raymond that the exopodite and endopodite were adherent for some distance, so that the anomaly of the separation of these branches at the level of

the gnathobase is removed. There is thus no reason to envisage the possibility, which I formerly suggested, that the outer ramus (whichever it be) of the limb of the Trilobita is not an exopodite, but an epipodite. In the limb of *Neolenus* the endopodite (in Storch's sense), though it has no endites, bears what looks very much like an apical lobe. It is interesting to note that the exopodite does not form with this a pair of distal rami as in the trunk-limbs of Anostraca and the hinder members of the series in *Lepidocaris*, but stands on the outer side of the limb, as in the anterior trunk-limbs of *Lepidocaris* and in all other Branchiopoda.

The interest of this suggestion lies in the fact that, if it be justified—which, of course, in the nature of the case can only completely come about as the result of further investigation,—we have in the Trilobita a group in which (a) all the limbs, save the antennules, were of the type which exists on the trunk only of the Brachiopoda and (more modified) on the maxillulary and maxillary segments of various other Crustaceans, and (b) the inner border of the limb was continuous and not broken into endites, save for the gnathobase. Thus the evolution of the limbs of modern Crustacea would seem to have comprised the following stages: (1) a phyllopodium with a continuous filtering fringe on the inner border, (2) the breaking of this border into endites, (3) the strengthening of the cuticle of the limb with the development of various systems of jointing necessitated by this, adapted to the various uses to which the limbs were put, and in the most complete cases providing a separate segment for each endite, (4) the loss of endites and departure from the phyllopodial form in various directions, some of which ended in the appearance of perfect biramous limbs.

Storch holds that the trunk-appendages of the Marellidæ, which have no gnathobases, represent a stage which preceded the first in the above list and in which the gnathobase had not yet been developed. That is possible; but in view of various unprimitive features of the Marellidæ it is a little doubtful. The absence of the gnathobase in Anostraca and Cladocera Anomopoda is probably secondary, since that endite is found in *Lepidocaris* and in Ctenopoda, and as regards Anostraca for further reasons which are given in my paper of February last. That a stage with continuous bristle-fringe and without gnathobase formerly existed is indeed probable, but that it has persisted continuously in any Crustacean known to us has yet to be conclusively demonstrated.

### III.—*The Protozoal Stage in Decapod Development.*

By ROBERT GURNEY.

THOSE who have occupied themselves to any extent with the study of the larvæ of Decapod Crustacea can hardly have failed to be struck by the similarity between the first three stages in the development of most diverse families, and to have speculated as to its significance.

In a typical case, such as *Leander* among Caridea, the first larva has sessile eyes; the telson is armed with fourteen spines; there are three pairs of biramous maxillipedes; and the pereiopods, if present at all, are small functionless rudiments.

At the first moult the eyes become stalked, spines appear on the carapace (if any are developed in the species); the telson acquires an additional pair of spines, and one pair of legs becomes functional. Otherwise the changes are small. At the second moult the changes are again small with one exception—namely, that the uropods appear, the endopods being almost invariably without setæ. Certain other characters of these stages are dealt with below. I do not attach much importance to the numbers of appendages functional at each stage, since this largely depends on the amount of yolk in the egg and the presence of more or fewer leg-rudiments on hatching. The points to which I wish to draw attention are the appearance of the uropods always at stage III., and the retention up to this stage of a style-like setigerous endopod by the 2nd antenna.

At the next moult, or stage IV., the animal approaches the "*Mysis*"-stage; the endopod of the 2nd antenna is a simple rod without setæ, and the telson begins to become narrow and parallel-sided.

Now let us consider the development of the more primitive Eucarida, the Euphausiacea, and Penæidea. In the latter there are three (or four) *Nauplius*-stages followed by three Protozoa stages, the latter characterized by the possession of natatory 2nd antennæ with jointed branches and very long setæ; a carapace which is free from the tergites of the somites behind the 2nd maxilla, and a forked telson with fourteen spines. The eyes are sessile in stage I., becoming stalked in stage II.\* (but not in *Lucifer*), and the thorax is

\* It should be noted here that Claus draws a distinction between Protozoa and Zoa stages, including in the latter the stages which I speak of here as 2nd and 3rd Protozoa stages. This point will be dealt with below.

fully segmented from the first. The mandible has no palp; both pairs of maxillæ have large jointed endopods and small setigerous exopods. The second stage differs little from the first, except that the abdomen becomes segmented; but in the third stage rudiments of all the legs appear together (in some cases the fifth pair is delayed), and the uropods are formed, the endopods being without setæ. The next moult gives rise to the *Mysis*-stage, which is generally of a very different appearance, the 2nd antennæ in particular being no longer natatory, and the character of the mouth-parts is, as a rule, greatly changed in the direction of the adult form.

In the Euphausiacea the four *Nauplius*-stages are followed by the "*Calyptopis*," and here again there are three stages, the uropods being acquired at the third. The *Calyptopis* is clearly the equivalent of the Penæid Protozoa, although it differs in the great compression of the thoracic region and the absence from it of all appendages except the first, while the second antennæ, though natatory in function, are relatively small and indistinctly joined. It is, in these respects, probably less primitive than the Penæid larva. It differs also strikingly in the form of the telson and in some details of the appendages, and the long series of "*Furcilia*" and "*Cyrtopia*" stages which follow the *Calyptopis* are not represented in Penæid ontogeny. In the long and gradual series of changes, and in the mode of appearance of the pleopods, the Euphausiacea seem to have retained a more primitive mode of development.

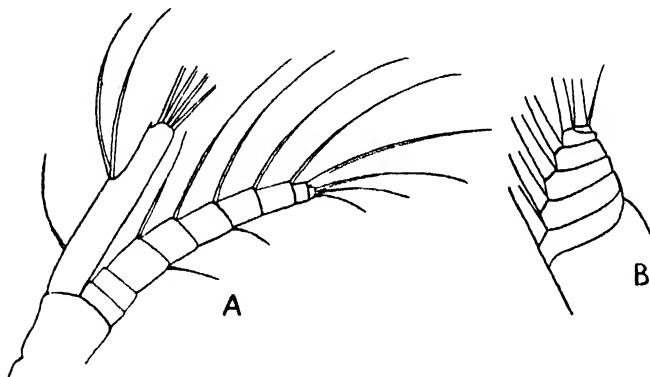
Assuming, then, that Decapod development was primitively a gradual one somewhat after the manner of that of the Euphausiacea, and that the first three post-naupliar stages—the Protozoal series in the Penæidea and the *Calyptopis* stages in the Euphausiacea—are more or less unchanged stages in it, may we not also suggest that the first three stages in the development of the Caridea are also protozoal? At first sight they seem to have but little in common with the Protozoa, from which they differ both in general type of structure and in mode of locomotion, but rather resemble the succeeding *Mysis*-stage of the Penæidea. None the less there are characters which can be pointed out which do not belong to that type of structure and seem actually to be survivals from the Protozoa.

They are the following:—

1. The eyes in stage I. are never stalked nor free from the carapace. The nauplius eye is always present.
2. The rostrum is, in some cases, either entirely absent or so small as to be traceable with difficulty.

3. Frontal organs may, very rarely, be present (*Pontophilus fasciatus*).
4. Spines on carapace or abdomen are, when present in later stages, never developed in Stage I., except sometimes on the fifth abdominal somite.
5. The peduncle of the first antenna is at first always unjointed.
6. In the 2nd antenna the endopod is, in the first three stages, always a rod bearing one or more plumose setæ or spines and never flagelliform. The exopod or scale is nearly always more or less jointed. In most cases it bears two outer setæ, and these setæ are placed in exactly the same position as in the

Fig. 1.



A. Second antenna of the first Protozoa of *Lucifer hanseni*.

B. End of exopod of 2nd antenna of a Euphausiid *Calyptopsis*, Stage II.

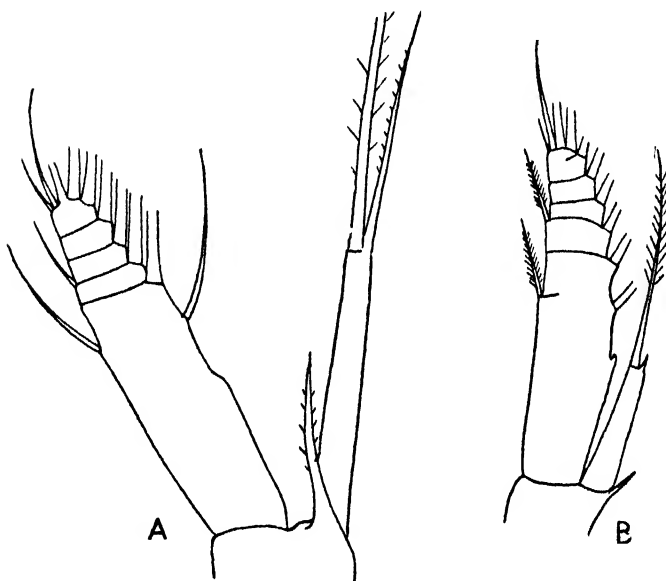
Protozoa of Penæidea. In the latter the proximal seta is borne by the third joint (from base) and the second on the fifth joint, the fourth having none (fig. 1 A) \*. This seems to be an invariable rule.

Now, in the Caridea the jointing of the exopod is more or less suppressed, and the first seta is generally borne on a part of the stem which shows no sutures; but it corresponds in position to the first proximal inner seta, and the second outer seta stands on the suture on which is borne also the

\* These lateral setæ appear to be absent in the Euphausiacea (fig. 1 B).

third inner seta (fig. 2). In some cases (e.g., *Alpheus*, *Typton*) when jointing is most complete there is a distinct trace of a suture corresponding to the first inner and outer setæ; then follows a joint bearing an inner seta only, while the next bears the second outer and third inner setæ (fig. 2 B). This may seem a very small point, but its very triviality seems to make it the more significant, and I hold that this arrangement of the setæ is

Fig. 2



A. Second antenna of *Pandalina brevirostre*, Stage I.

B. Second antenna of *Alpheus* (*audouini*?), Stage I.

definite evidence that the second antenna of the Caridean larva is actually the natatory antenna of the Protozoa comparatively little changed.

7. In some Caridea (*Caridina*, *Atyephyra*, *Paratya*, Hoplophoridae) the 1st maxilla bears an exopod with setæ precisely the same as that of the Protozoa of the Penæidea (and the *Calyptopis*). When this exopod is absent one or more setæ may be found in place of it (e.g., *Processa*).
8. In the second maxilla the exopod has no proximal

extension and bears few setæ, while the whole appendage is much more leg-like and less foliaceous than it afterwards becomes.

9. The deeply incised form of telson in some genera (e. g., *Pandalus*, *Pontophilus*) is no doubt derived from the bifurcate form of the Protozoa, and the form of the telson generally changes at the second moult.

This comparison is made between the Protozoa of the Panæidea and the Zoa of the Caridea since in the latter these primitive features are more commonly retained than in the Reptantia, among which development is frequently abbreviated or the form of the larva specially modified, as in the Palinura and Brachyura. In the majority of the Reptantia the exopod of the 2nd antenna is unjointed and already provided with a terminal spine. The only example of a normally jointed exopod of which I am aware is that of *Stenopus*; but in *Naushonia*\*, for instance, the exopod has a very elongated slender form without terminal spine, and exactly of Caridean form though not jointed. The endopod is commonly more protozoan than in Caridea, having frequently two, and sometimes three, long plumose setæ (*Upogebia*, *Naushonia*). When the larva of an Anomuran or a Thalassinid hatches as a normal Zoa, the uropods are acquired at the second moult as in Caridea (e. g., *Upogebia*), and there is no reason to doubt that these stages are precisely equivalent to those of Caridea, although the protozoan characters have been almost entirely effaced by a further encroachment of the *Mysis* characters.

There is, however, a serious difficulty in accepting these early stages of the Caridean larva as actually representing the three stages of the Protozoa. It is well known that on, or soon after, hatching, the larva sheds a cuticle which in many cases shows on the antennæ and telson long plumose setæ which do not always correspond to those of the free larva. This is especially the case with the Brachyura, where the exopod of the 2nd antenna sometimes bears several large setæ, and the telson has a form much resembling that of the Caridea, and having fourteen setæ. This embryonic cuticle has been supposed, and with good reason, to represent a protozoal stage which has been passed through in the egg and never comes to functional life†. It is impossible to explain these structures without assuming that they were

\* Specimens from Samoa collected by Dr. P. A. Buxton.

† Conn. Stud. Biol. Lab. Johns Hopkins Univ. iii. 1884, pp. 1-35.



once functional in a larval stage which has become embryonic, but, if we are justified in believing that the three protozoal stages actually still persist as free, though modified, larvæ, then this embryonic stage must be pre-protozoal—that is to say, *Metanaupliar*.

It may seem at first sight absurd to see a *Metanauplius* in an embryo provided perhaps with three pairs of large maxillipedes, but the difficulty is not so great as it might seem. In the first place, the Penæidæ pass through a stage which is strictly intermediate between *Nauplius* and Protozoa and possesses the same number of appendages as the latter, though in a rudimentary condition. It even has, in some cases at all events, the same number and arrangement of spines on the telson. We do not, however, know whether twelve or fourteen spines is the usual number in the metanaupliar stage. The fact that in the Caridæa the embryonic telson bears six pairs of setæ only (to which an inner pair is added in the first free larva) indicates that the stage represented is one earlier than the Protozoa, since seven pairs seems to be the rule in the latter. In the Euphausiacea the telson of the *Metanauplius* bears, according to Sars\*, three pairs in *Nyctiphanes australis* and seven pairs in *N. norvegica*†. In *N. couchi* there are 6–8 spines (Lebour‡), while in a *Metanauplius* from the Atlantic ('Terra Nova' collection) there were five spines on either side. There seems, therefore, to be no fixed number in the *Metanauplius* either in the Euphausiacea or the Penæidæ as there appears to be in the *Calyptopis* and the Protozoa. The embryonic telson of the higher Decapoda may, then, quite as well be that of a *Metanauplius* as of a Protozoa.

There is nothing in the antennæ of the embryonic cuticle distinctive of the Protozoa rather than of the *Nauplius*. The stage represented must have had a 1st antenna more natatory than sensory, since it was provided with large plumose setæ. It is not unusual to find long setæ on the embryonic 1st antenna in *Brachyura* and *Anomura*. These setæ are terminal, but in a species of *Porcellana* from Samoa a similar seta is borne on the peduncle in addition to the terminal setæ (fig. 3). Of this species numbers of larvæ were found in plankton collected by Dr. P. A. Buxton, and one of them which had just left the egg retained the embryonic cuticle. This cuticle showed also a remarkably well-developed 2nd antenna with six large setæ on the

\* 'Challenger' Reports—Schizopoda.

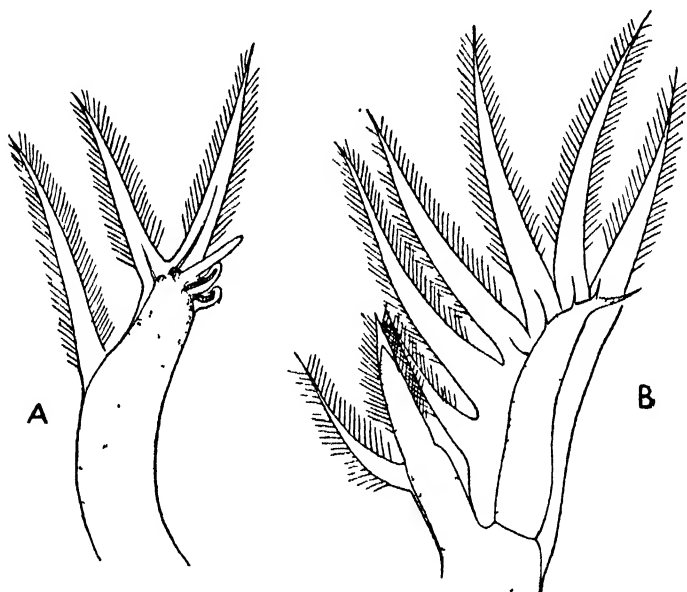
† Arch. Math. Nat. xx.

‡ Journ. Mar. Biol. Ass. xiii.

exopod and two on the endopod, while the telson had only six pairs of setæ as in the Caridea.

In no case, so far as is known, does this cuticle show any setæ on the mandibles or other limbs. If this skin represented that of a Protozoëa one would expect that some of the limbs would in some cases bear setæ as the antennæ do. On the other hand, none of these limbs are functional in the *Metanauplius* and therefore would not develop setæ in

Fig. 3.



*Porcellana* sp.

First antenna (A) and second antenna (B) of larva just hatched, showing setæ of embryonic cuticle.

the embryo. It is true that the mandible is a functional swimming-leg in the *Nauplius* and sometimes in the *Meta-nauplius*, but there is a strong tendency to its suppression as such, and the swimming branch when present is in process of atrophy during the last *Nauplius*-stage.

My proposition may therefore be summarized thus :—

1. The Euphausiacea retain the mode of development of the ancestral Decapoda.

2. The primitive series of stages is retained in the Penæidea up to the third Protozoëa, but from that point onwards development has been compressed, more or less in different groups, by early acquisition of adult characters.
3. In Caridea and some Reptantia the *Nauplius*-stages only are passed through in the egg and the larva hatches as a modified Protozoëa. The process of compression of later development begun in the Penæidea has extended here even to the first free stage.

The advantage to be obtained by the acceptance of the view that the last embryonic stage of the higher Decapoda represents the *Metanauplius* is that the development of all Eucarida can then be regarded as simple modifications of a single type. The protozoëal series as seen in the Penæidea is no doubt a close approximation to the ancestral larval series, and has been more and more obscured by the early appearance of characters of the adult Decapod and of structures due to the adoption of new larval habits.

In the Penæidea the peculiar mode of swimming of the Protozoëa is graphically described by Müller (1863\*, p. 9), "Ein Mann, der senkrecht im Wasser schwebend, mit weit ausgebreiteten Armen, schwanke Weidengerten in der Hand, sich emporarbeiten wollte, würde ein Bild der eigenthümlichen Bewegungsweise geben, an der man auf den ersten Blick unter Hunderten anderer kleine Kruster diese *Nauplius* und die daraus hervorgehende *Zoea* erkennen kann." The transformation from Protozoëa to *Mysis*-stage marks a great change of habit of swimming, the functions of the 2nd antennæ being taken over by the exopods of the legs, and the antennæ and tail-fan forming balancing and directive organs. The long flexible abdomen of the Protozoëa with its relatively feeble musculature one may suppose to be unsuited to a mode of horizontal progression which requires a more compact form, and a shifting backwards of the locomotor organs, while the flattening of the antennæ and telson would greatly assist stability. The extreme compression of the thoracic somites, which are not separately distinguishable in the larvæ of the Caridea, for example, is no doubt a special adaptation of the Protozoëal form for the

\* Archiv für Naturg., xxix.

achievement of compactness. It would be of interest to know what is the mode of swimming of the *Euphausia* larvæ, as to which there is no published information. The reduction of the thoracic region, the plate-like telson, and the slightly segmented 2nd antennæ would lead one to suppose that they swim horizontally and not vertically as in Penæidæ.

#### THE TERMS "PROTOZOA" AND "ZOA."

If the term Protozoa is adopted in the sense here advocated, the name Zoa becomes redundant. The name properly belongs only to the larva of the Brachyura, in which the modification of the protozoal type reaches an extreme. There is, however, no fundamental distinction to be drawn between the larva of a Brachyuran and that of a Caridean for example, and the name originally applied to the former has been extensively used to designate all Decapod larvæ in which the thoracic region is more or less undeveloped. Though the Brachyuran larva is not essentially different from that of other Decapods, it has undoubtedly special structural features which make it readily distinguishable, and it might be a convenience to restore the term Zoa to its original meaning. It has, however, been too long in use in a wider sense to make such a restriction practicable now, and it is doubtful if it is even advisable to retain it at all to define any particular developmental stage. In the Penæidea there is no Zoa stage, for the protozoan characters are retained at least until the whole of the thoracic appendages are developed, and only two series of stages, those of the Protozoa and of the *Mysis*, can be recognised. In the Caridea and the Reptantia, if the first three stages are to be regarded, as I think they should be, as modified Protozoas, a Zoa stage with suppressed thoracic region cannot be recognised, the Protozoa developing, as in the Penæids, into a *Mysis*-stage. At the same time the Protozoa has been so much modified by early appearance of *Mysis*-characters that it has lost most of its essential features, and no serious objection can be raised to applying the name Zoa to these early stages provided that such a use of it does not obscure the fact of the essential unity of type throughout the Eucarida.

IV.—On Mammals collected by Captain C. R. S. Pitman,  
Game Warden, Entebbe, Uganda. By A. E. RUXTON.

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THIS collection has been made, except where otherwise stated, in the Eastern Trans-Nzoia district, the Cherangani Hills, and on the River Kerio Suk, Kenya Colony, lat.  $0^{\circ} 56' N.$ , long.  $35^{\circ} 16' E.$

The altitudes for all specimens except those with the word "Suk" after the collector's number, are from 6000' to 6400'; those from the River Kerio Suk, 3500'.

The collection contains a fine series of six skins and five skulls of a new species of oribi from Lake Nakivali, Ankole, Uganda.

1. *Cercopithecus albogularis* subsp.

♂ . 92; ♀ . 127, 129. Skulls only.

2. *Galago brascatius albipes*, Dollm.

♂ . 123, 132, 141; ♀ . 122, 125; and 97 (sex not stated).  
"No. 141. One of a small party which lived in a hole of a broken branch of a lofty '*Podocarpus*' 40' above the ground. They emerge each night just before dusk, moving rapidly from tree to tree, and are not easy to shoot. Plentiful in hollow trees in grass-land and ravines."

3. *Lavia frons frons*, Geoff.

♀ . 11 (Suk).

4. *Nycteris thebaica*, Geoff.

♀ . 166; and 24 (Suk), sex not determined.

5. *Rhinolophus keniensis*, Holl.

♂ . 169, 180.

6. *Hipposideros caffer centralis*, K. And.

♂ . 164.

7. *Hipposideros caffer typicus*, Sund.

♂ . 177, 179; ♀ . 174, 178, 181, 182.

"This species appears to be fairly plentiful."

8. *Pipistrellus nanus*, Pet.

♂ . 124.

9. *Atelerix kilimanus*, Thos.

♀ . 20 (Suk).

"Caught in my camp on the banks of the Kerio at 11 P.M. ; the only one seen."

10. *Crocidura bicolor elgonius*, Osg.

♀ . 44.

"Caught by the cat at dusk in short grass near dwelling-huts."

11. *Crocidura turba kemp*i, Dollm.

♀ . 157.

12. *Elephantulus dundasi*, Dollm.

♀ . 3 (Suk), 14 (Suk).

"No. 3 (Suk). Shot in stony scrub-land in the morning. Fairly common, preferring patches of the large pithy reeds, which the elephants eat."

13. *Nasilio delameri*, Thos.

♀ . 315. Near Lake Nakivali, Ankole, Uganda, 4300'.

"Trapped by day. Acacia and grass country. Rainy season."

14. *Felis serval kemp*i, Wrought.

♀ . 133.

"Weight 5 lbs. Height at shoulder 34". Shot in scrub and tree country. First specimen seen."

15. *Hyæna* sp.

♂ . 38, 39. Skulls only.

16. *Lycaon* sp.

96. Skull only ; no sex stated.

17. *Thos adustus* subsp.

Skin only ; no label.

18. *Genetta stuhlmanni*, Matsch.

♂ . 40 ; ♀ . 56, 145.

"No. 56. Caught in an unbaited gin. Had gnawed off paw of foot that was caught in trap.

"No. 145. Caught in gins set at the bottom of a thickly

overgrown ravine. A sparrow-hawk first came to bait and was caught. Then the genet came after the hawk and was trapped, but it spent its time by devouring nearly the whole of the hawk! Fairly common, bold and fearless."

19. *Ictonyx striatus albescens*, Hell.

♂. 140.

"Weight  $4\frac{1}{2}$  lbs. Very bold and easy to trap, once they have tasted blood. Not uncommon."

20. *Ichneumia albicauda ibeana*, Thos.

♀. 162.

"Trapped by night in a mealie store, where it had evidently gone to catch rats."

21. *Heliosciurus rufobrachiatatus nyansæ*, Neum.

♂. 34, 36, 37, 42, 64, 99, 131, 170, 173; ♀. 35, 159, 168, 172.

"No. 64. Had two peculiar glands as large as hazel-nuts in stern, and filled with a thick substance like lanoline.

"No. 168. Weight  $1\frac{1}{2}$  lbs. Common in cover and trees near rivers, streams, etc. Six teats (two breast, four abdomen)."

These specimens vary considerably in colour of underside. No. 159 has a darker coat than the other specimens, having been shot at an altitude of 8000' in the forest, whereas the remainder were secured at 6000' in more or less open country.

22. *Heliosciurus multicolor elegans*, Thos.

♂. 6 (Suk); ♀. 10 (Suk), 23 (Suk), 25 (Suk).

"Weight about  $\frac{3}{4}$  lb. Seems fairly common."

23. *Xerus rutilus dorsalis*, Dollm.

♂. 22 (Suk).

24. *Paraxerus ochraceus electus*, Thos.

♂. 4 (Suk), 9 (Suk); ♀. 1 (Suk), 7 (Suk), 8 (Suk).

"Weight  $\frac{1}{2}$  lb. approx. Not very shy. Fairly common where cover is suitable."

25. *Euxerus erythropus leucoumbrinus*, Rüpp.

♀. 2 (Suk), 21 (Suk).

"Shot on ground in thorn-scrub. Plentiful and fearless."

26. *Claviglis microtis saturatus*, Dollm.

♀ . 83, 156.

27. *Taterona nigricauda nyama*, Dollm.

♀ . 12 (Suk).

28. *Æthomys chrysophilus voi*, Osg.

♀ . 15 (Suk).

29. *Æthomys kaiseri noræ*, Wrought.

♂ . 55 ; ♀ . 49.

"Contained three young in foetus state."

30. *Lemniscomys striatus massaicus*, Pag.

♂ . 41, 48, 51 ; ♀ . 33, 52, 104.

"Lives in holes under trunks and roots of trees. Quite common."

31. *Tachyoryctes ruddi*, Thos.

♂ . 90.

32. *Arvicanthis abyssinicus præceps*, Wrought.

♂ . 16 (Suk).

"Trapped by day in scrub near river. Very common."

33. *Arvicanthis abyssinicus nubilans*, Wrought.

♂ . 50, 59, 74, 100, 106, 139 ; ♀ . 26, 54, 58, 67, 70, 75, 76, 77, 79, 94, 103, 107, 110, 111, 112, 113, 136, 138.

34. *Mastomys coucha ugandæ*, de Wint.

♂ . 78, 80 ; ♀ . 32, 61, 68, 69, 82, 95.

"No. 68. Trapped in the evening in mealie store. Had ten pairs of teats."

35. *Praomys jacksoni*, de Wint.

♂ . 87, 142 ; ♀ . 47, 57. One specimen with no label.

"Lives in holes under tree-trunks and roots of trees."

36. *Lophiomys ibeanus*, Thos.

♂ . 148 ; ♀ . 118, 134, 135.

"Weight  $1\frac{1}{2}$ – $2\frac{1}{2}$  lbs. Trapped by boys with noose and stick in wady full of cover. Common in such localities."



37. *Cricetomys gambianus elgonis*, Thos.

♀. 53, 126 ; 151 (sex not stated). One skin with no label.

"Weight about 2½ lbs. Fairly plentiful, but rarely seen."

38. *Leggada sorella*, Thos.

♀. 105, 109.

39. *Leggada grata*, Thos.

♀. 27, 28.

"Quite plentiful, but rarely seen."

40. *Lepus victoriv*, Thos.

♂. 150, 155.

"Plentiful during the season of long grass. Weight 4½ lbs."

41. *Lepus tigrensis*, Blanford.

♀. 19 (Suk).

"Shot in scrub and thorn desert. Not plentiful. Many localities seemed absent."

42. *Procavia (Dendrohyrax) bettoni*, Thos. & Schw.

♀. 65.

"Shot in a small bushy tree in open grass-land. It was being mobbed by a lot of birds. Hardly concealed and not 12 feet above the ground."

43. *Procavia* sp.

♀. 152.

Too young to determine the species accurately.

44. *Tragelaphus scriptus* subsp.

♂. 176. Skull very damaged and bunt.

"Caught the day it was dropped. Bottle-fed for three days, but died. Bleated like a lamb. Weight 9 lbs."

45. *Madoqua (Rhynchotragus) nasoguttata*, Lönnb.

♂. 5 (Suk).

"Weight 10 lbs."

46. *Ourebia pitmani*, sp. n.

♂. 307, 308, 317; ♀. 304, 306, 309. Near Lake Naki-vali, Ankole, Uganda. 4300'.

*Colour*.—Neck, shoulders, legs, and thighs fawn. Back: tips of hairs black for 1–2 mm., then red-brown for 4–5 mm., then black, merging into red-brown to base, giving a grizzled appearance. Hair wavy. Changes abruptly to white underneath. Face fawn, but the forehead is dark red-brown with a darker, almost black patch between the ears. Tail black. Inconspicuous superciliary stripe. Subauricular patches bare and large (20 mm. across).

Body-measurements: head and body 39"; tail 3½"; hind foot 3½"; ear 4½".

Skull-measurements: greatest length 160 mm.; basal length 140 mm.; greatest width 75.5 mm.; length of nasals 61 mm. (approx.) × 19 mm.; length of upper tooth-row 49.5 mm.

Horns 7" in length and heavily ridged to more than half their length, sloping strongly back and nearly straight.

*Type*. Adult male. B.M. no. 26. 5. 12. 109. Original number 307. Collected November 1925.

*Hab*. Capt. Pitman states:—"This race of oribi is only found in a tiny area of Uganda, in the vicinity of Lake Naki-vali and the adjacent lakes in Ankole.

"Common on grassy uplands in twos and threes. Very shy and difficult of approach. Height at shoulder about 23"–24". Weight 33 lbs."

This species of oribi is readily recognized by the wavy hair and grizzled appearance of the back, also by the nearly straight, heavily ridged horns.

47. *Oreotragus oreotragus schillingsi*, Neum.

♂. 301. Gayaza, Ankole, Uganda, 5000'.

"Quite common in twos and threes on the rocky hills."

48. *Cephalophus (Sylvicapra) grimmi*, Linn.

♂. 319, 320, 321, 322. Near Lake Kalitima, Ankole, Uganda, 4200'.

"Average weight 27½ lbs. Average height at shoulder 20½".

"Common in cover at the edge of lakes and in the thicker patches of scrub."

49. *Cephalophus melanorheus* subsp.

Two skins from Ankole, Uganda.

V.—*Some African Apterygota.*

By JAMES MEIKLE BROWN, B.Sc., F.L.S., F.E.S.

[Plates II. &amp; III.]

THE material described in the present communication was collected during 1917 in West and South Africa by Dr. P. A. Buxton, to whom I am greatly indebted for the opportunity of examining the specimens. Seven tubes of alcohol material were submitted, containing in all seven species, of which five belong to the Thysanura and two to the Collembola, most of them being, apparently, undescribed forms.

## Order THYSANURA.

## Family Lepismidæ.

## Subfamily NICOLETIINÆ.

## Genus ATELURA, Heyden.

*Atelura nana*, Esch.*Grassiella nana*, Escherich, Zool. Anzeig. 1903, p. 352.*Atelura nana*, Escherich, Zoologica, 1904, p. 127.

One female evidently referable to this species.

Thoracic tergite i. with four rows, tergites ii. and iii. with two rows of premarginal macrochætæ. Abdominal tergites each with one row of similar macrochætæ. Styles carried by the abdominal sternites 6 to 9, and vesicles by the abdominal sternites 6 and 7.

Abdominal tergite x. deeply incised, with a long spine at each apex and two smaller ones within.

Ovipositor not fully developed, the specimen being immature.

Size 1·5 mm.

*Locality.* Durban, 11. vii. 1917.

*Atelura natalensis*, sp. n.

*Female.* Yellowish white. Scaled. Body lepidisma-like, widest across the thoracic segments, rounded in front and strongly tapering towards the posterior end. Length of the body about 2·75 times the width of the thorax. Abdomen at the base not narrower than the thorax. Head ventrally flexed.

Head with numerous irregularly scattered bifid macrochætæ, which are especially numerous on the anterior margin. Eyes absent.

Antennæ reaching to the posterior margin of the mesothorax.

Mandibles strongly toothed, and with broad masticatory ridges. The teeth of the two mandibles asymmetrically placed.

Inner lobe of the maxilla bifid. Outer lobe with one truncated, conical, sensory structure at the apex (Pl. II. fig. 5 *a*). Maxillary palp with the segments in the proportion 4:10:10:10:15. Apex of the terminal segment with three sensory structures, elongate and cylindrical in shape, with rounded apex, and carrying numerous short hairs at the apex (Pl. II. fig. 5 *b*).

Labial palp with four segments. Segments 1 and 2 small and cylindrical, segment 3 broadly triangular, and segment 4 much enlarged, flattened, broadest across the middle and truncated at the apex, with the usual six sensory papillæ (Pl. II. fig. 6).

Tergites of the thoracic and abdominal segments, each with one row of long strongly bifid premarginal macrochætæ, which are longer at the post-lateral margins of the abdominal tergites (Pl. II. fig. 4). Thoracic tergites with a very strong lateral fringe of simple backwardly directed macrochætæ.

Tergite x. deeply incised, with a strong simple bristle at each apex and four shorter bifid ones, two within and two above the apices (Pl. II. fig. 3).

Legs armed with strong bristles and flattened blade-like spines, especially numerous on the inner side of the tibia. Apex of the tibia on the outer side, with one very prominent, simple, untoothed spine and two shorter but strongly bifid spines. Tarsi four-jointed, with strong bristles. Lateral claws narrow and strongly curved towards the apex. Empodium narrow and shorter than the claws (Pl. II. fig. 7).

Abdominal sternites 2 to 9 each with a pair of styles, and sternites 6 and 7 each with one pair of vesicles. The vesicles of sternite 6 provided with six or seven curved bristles, those of sternite 7 without.

The styles of segments 2 to 8 subequal in length, that of segment 6 being about one-half the length of the sternite. The style of segment 9 nearly twice the length of that of segment 8 (Pl. II. fig. 2).

The abdominal sternites 1 to 4 each with a row of short macrochætæ on the posterior margins. Sternite 5 with two

submedian and four or five post-laterals on each side; sternite 6 with one submedian and four or five post-laterals.

Cerci short, thick, and strongly tapering, about 1.5 times the length of the style of sternite 9. Median filament rather more than twice the length of the lateral cerci.

Ovipositor pouch-like, reaching rather beyond the apex of the style of sternite 9—that is, rather longer than the subcoxa and style together of that segment (Pl. II. fig. 1). Gonapophyses thick, widened in the middle, especially those of sternite 8, and indistinctly segmented, with long erect hairs towards the apices, especially prominent on those of segment 9, which have the usual comb-like interlocking arrangement on the inner side near the tips (Pl. II. fig. 1 a).

Dorsal scales about 6 times as wide as long, and provided with numerous ribs (Pl. II. fig. 4).

*Male* similar to the female in general characters.

Urotergite x. strongly incised and similar to that of the female.

Styles as in the female. Sternite 5 with two, and sternites 6 and 7 with one submedian macrochaeta on each side.

Urosternite 8 prolonged between the styles and slightly incised in the middle, with four macrochaetae on each side. Paramera subcylindrical, about one-half as long as the style of sternite 9. Penis short, scarcely reaching to the middle of the paramera (Pl. II. fig. 2).

Cerci with three strong, short, blunt, peg-like processes on the inner side near the base (Pl. II. fig. 9).

Length, male and female, 3 mm.

*Locality.* Under a stone, Umkomaas, Natal, 16. vii. 1917.

This species appears to resemble most *A. anommatis*, Esch., from the Congo region (Escherich, 1904, p. 128), but differs in that the first style is not rudimentary, being in that species shorter than the vesicle of that segment. The ovipositor in the present species is not rod-like, but valve-like and swollen. The size is also very different, *A. anommatis* reaching 5.5 mm.

The members of this genus are usually found in the warmer parts of the earth associated either with termites or with ants, the species most closely allied to the present one being commonly taken in ants' nests. The individuals described here occurred under a stone, but this does not preclude the possibility of their being myrmecophilous also.

#### GENUS LEPIDOSPORA, Escherich.

##### *Lepidospora neglecta*, sp. n.

Body yellowish white, scaled dorsally and ventrally. Body

broadest across the fourth abdominal segment, and tapering slightly towards the anterior end and more strongly towards the posterior end.

Head as broad as long, dorsally with short scattered setæ. The anterior and lateral margins bear numerous macrochætæ, which are most prominent near the bases of the antennæ. The longest chætæ are split at the apex. Eyes absent.

Antennæ long, subequal to half the length of the body. Basal segment robust, its length twice its width. The proximal segments are simple, the median ones are subdivided into two, and the more distal ones into four sub-segments. Segment iii. with eight sensory hairs, having the form of a long, fine, flexible, thread-like hair arising from a slight papilla, which is surrounded by a raised ring-like thickening (Pl. II. fig. 10 *a*). Each of the more distal segments is provided with a median circlet of eight long setæ and several less regularly arranged smaller ones, a dense covering of fine hairs, three or four blunt and flattened structures towards the apex of the segment, and occasionally a sensilla similar to those carried on segment iii. (Pl. II. fig. 10 *b*).

Mandibles asymmetrically toothed, the teeth of the right mandible being more numerous than those of the left. Below the broad masticatory ridges are seven short stumpy spines arising from slight papillæ.

The external lobe of the maxilla bears two apical sensory structures in the form of cylindrical processes with a terminal fringe of short hairs (Pl. III. fig. 11 *b*). The inner lobe is bipartite at the apex. The palp is five-jointed, the segments being in the proportion 1:2:2:2:3. The apex of the terminal segment is provided with six sensory structures, differing from those carried by the external lobe in having the form of cylindrical papillæ with rounded apex and carrying fine hairs all the way up (Pl. III. fig. 11 *a*).

Labial palp long and four-jointed. The last segment is much dilated, broad and rounded, and about as broad as long (Pl. II. fig. 11).

Thoracic tergites with strong marginal setæ, four or five on the post-lateral margins being the most prominent.

Abdominal tergites with numerous short hairs and six or seven strong macrochætæ on each side of the posterior margins. Lateral setæ absent.

Anterior abdominal tergites subequal in length.

Legs strongly armed, especially on the inner side of the tibia with broad, flattened, blade-like spines, and carrying at the apex a toothed claw-like spine. Tarsi with a row

of strong inner spines. Lateral claws distinctly longer than the empodium (Pl. II. fig. 12).

Urotergite x. rather shorter than its basal width (about .8 times). Its lateral margins are at first convex outwards, then rapidly tapering. The posterior margin incised, but not very deeply, and with a long bristle at each of the posterior angles, about equal to half the length of the tergite, and three smaller ones on the outer margins (Pl. III. fig. 10).

Urosternites 2 to 7 each with a pair of vesicles, and urosternites 2 to 9 each with a pair of styles. Sternites provided with scales and a few scattered hairs, together with several stronger ones on the posterior margins.

Median part of urosternite 8 subtriangular with rounded sides and posterior angle (Pl. III. fig. 9).

Style of sternite 9 about 1.3 times the length of that of sternite 8.

Ovipositor thick and long and projecting beyond the style of sternite 9 by a distance equal to the length of that style. Gonapophyses of segment 8 slightly shorter than those of segment 9, and like them distinctly but imperfectly jointed, especially in the upper part, into apparently about 26 segments (Pl. III. fig. 9).

Lateral cerci thin and attenuated, about one-half the length of the body. Median filament missing.

Length of body 7.5 mm.

*Locality.* Umkomaas, Natal, 16. vii. 1917.

In the form of ovipositor, the present species most resembles *L. ceylonica*, Silv. (1910, p. 95), *L. buxtoni*, Silv. (1923, p. 260), and *L. notabilis*, Silv. (1913 b, p. 61), in being composed of thickened gonapophyses, these also resembling the first two species in being jointed, but differing considerably from all three in being more elongated, projecting, in the present species, a good distance beyond the apex of style 9. From the other South African species *L. meridionalis*, Silv. (1913 a, p. 12), it differs in that species having a very elongated and slender ovipositor, very similar to that of *L. gracilis*, Esch. (1904, p. 178).

The mouth-parts resemble very closely those of *L. braueri*, Esch., as described and figured by Carpenter (1916, p. 18), the form and asymmetry of the teeth of the mandibles being remarkably similar, but the sensory structures at the tip of the maxillary palps are more cylindrical and not club-like, while the two sensory structures at the apex of the galea are not peg-like spines as mentioned for that species by Carpenter, but truncate cones with a single

circlet of fine cilia at the apex. The empodium of the foot is broader, and the spine at the apex of the tibia is finely toothed near the base.

The known species of *Lepidospora* can be arranged in an interesting and progressive series depending on the structure and length of the ovipositor, thus :—

- L. notabilis*, Silv. (1913 *b*, p. 61). Thick, unjointed, short, reaching to half the length of style 9.
- L. escherichi*, Silv. (1908, p. 382). Thick, unjointed, short, reaching to half the length of style 9.
- L. braueri*, Esch. (1904, p. 131). Thick, unjointed, rather longer than style 9.
- L. ceylonica*, Silv. (1910, p. 95). Thick, jointed, reaching to half the length of style 9.
- L. buxtoni*, Silv. (1923, p. 260). Thick, jointed, reaching slightly beyond style 9.
- L. neglecta*, mihi. Moderately thick, jointed, reaching much beyond style 9.
- L. meridionalis*, Silv. (1913 *a*, p. 12). Slender, jointed, very elongated.
- L. gracilis*, Esch. (1904, p. 178). Slender, jointed, far surpassing style 9.

## Family Machilidæ.

### Subfamily PRÆMACHILINÆ.

#### Genus PRÆMACHILIS, Silvestri.

##### *Præmachilis* sp.

Body covered with dark brown scales, with the bases of the segments paler. The antennæ, cerci, and median filament with narrow pale rings separating the broad dark bands. Legs paler at the joints.

Eyes about as broad as long, touching each other for a distance equal to about two-thirds the width of the eye. Paired ocelli roundish, wide apart, and placed just without the lateral borders of the eyes.

Antennæ rather more than half the length of the body (not quite complete in the specimens). Legs of the second and third pairs with coxal processes.

Median parts of the abdominal sternites about one-half the length of the urosternite.

A single pair of vesicles carried on each of the abdominal sternites 1 to 7. A pair of stylets on each of segments 2 to 9. Styles long, that of segment 5 being about equal to the length of the sternite.

Urosternite 8 produced into rounded median lobes. The



subcoxa of segment 9 narrow. The styles of segment 9 not quite twice the length of those of segment 8, and subequal to the subcoxa of segment 9.

Cerci nearly half the length of the body. Median filament broken, but approximating to the length of the body.

Ovipositor not fully developed, but represented by four papillæ.

Length of body 3-4.5 mm.

*Locality.* Sierra Leone, under stones, 17. v. 1917.

Unfortunately all three individuals were immature females, with ovipositors represented by two pairs of gonapophyses, attaining in the individual most advanced to barely the length of the style of segment 8. Hence the species, which does not appear to coincide with any described one, cannot be satisfactorily discriminated. This is unfortunate, as specimens of this genus do not seem to have been taken frequently in Africa.

#### Subfamily *MACHILINÆ*.

#### Genus *MACHILIS*, Latreille.

#### *Machilis africanus*, sp. n.

Body with scales reddish brown, paler beneath. Antennæ with a few paler rings.

Eyes with the margins in contact about one-half the width of each eye. Eyes wider than long. Ocelli transverse, much attenuated in the middle, the inner portion roundish, the outer portion elongate, the length being rather less than the width of the eyes (Pl. III. fig. 3).

Antennæ equal to the length of the body, entirely scaled, and with short setæ. The length of the basal segment about twice its width. The flagellum gradually tapering to the fine thread-like terminal portion, in which region the segments are subdivided into twelve or thirteen subsegments.

Mandibles with four blunt rounded teeth at the apex (Pl. III. fig. 7).

Maxillary palp scaled, gradually tapering (Pl. III. fig. 4). The relative lengths of the segments in the proportion 2:3:3:4:3:4. The terminal segment with a double row of thick marginal spines, and terminating in a single larger one, together with numerous long hairs (Pl. III. fig. 5). The basal segment with an external conical process. The external lobe of the maxilla distinctly longer than the inner lobe, and provided with numerous pointed apical sensilla.

Labial palp with the terminal segment subcylindrical, slightly asymmetrical, with numerous setæ and sensilla

towards the apex. The relative lengths of the segments as 1:1:2:2 (Pl. III. fig. 6).

The thorax only slightly convex dorsally. Legs with scales in the upper parts, densely hairy on the tibia and tarsi. Pretarsal claws weakly curved towards the apex. Coxal processes present on the second and third pairs of legs, that of leg 3 being slightly more than one-half the length of the coxa.

Abdominal sternites 2 to 6 each with two pairs of vesicles, and sternite 7 with a single pair. Styles present on sternites 2 to 9. The median part of the urosternites large, triangular, that of segment 5 occupying distinctly more than half the depth of the sternite. Urosternite 7 produced posteriorly as two rounded lobes. The subcoxa of sternite 9 narrow, obtusely triangular, the visible length being twice that of sternite 8, with two setæ on the inner angles (Pl. III. figs. 1 & 2).

Styles scaled, and with a few hairs. The style of segment 5 one-half the length of the sternite, with a prominent apical spine. The style of segment 9 with an apical spine almost half the length of the style, and with two curved subterminal bristles and several smaller hairs, the style of this segment being more than twice the length of that of segment 8 and about one-half the length of the subcoxa of the segment (Pl. III. fig. 8).

Ovipositor attenuated, rod-like, with almost parallel sides, and strongly annulated, not quite reaching to the apex of the subcoxa of segment 9 (Pl. III. fig. 1), the apex of the inner gonapophysis with one bifurcate seta and of the outer gonapophysis with one simple seta (Pl. III. fig. 1 a & b).

Lateral cerci equal to about half the length of the body. Median filament (incomplete) at least 1.5 times the length of the lateral cerci.

Length of the body 8 mm.; cerci 4 mm.; antennæ 8 mm.

*Locality.* Sierra Leone, West Africa, 17. vii. 1917.

The present species differs from other described African species, *M. dolichopsis*, Silv. (1908, p. 134), among other characters, in the shorter ovipositor, and from *M. acuminothorax*, Lucas, from Algeria (Silvestri, 1905), in general characters and body-form.

## Order COLLEMBOLA, Lubbock.

### Family Entomobryidæ.

#### Genus ENTOMOBRYA, Rondani.

##### *Entomobrya minima*, sp. n.

Body entirely yellowish white, except for the dark eye-

spot and a speck between the bases of the antennæ. The antennæ, especially towards the apex, with a faint violet tinge.

Eyes eight on each side, the anterior pair, and especially the inner one, distinctly larger than the others (Pl. II. fig. 13).

Antennæ about 1.6 times the length of the head. The relative lengths of the segments are in the proportion 2:5:5:9. All the segments hairy, and the terminal one bearing a subapical sensory papilla.

The abdominal segments are in the proportion 7:7.5:7:20:6:5, thus segment iv. is three times segment iii.

The spring is about .9 times the length of the antenna. Dens about 1.25 times the manubrium, the mucro very small. The manubrium with a few hairs, the dens dorsally crenulated to within a short distance from the mucro, dorsally with scattered hairs, and ventrally thickly covered with feathered hairs, several specially long ones arising at the base of the non-crenulated portion and reaching to the apex of the mucro. Mucro with two blunt teeth and no basal spine.

Legs with feathered hairs on the tibio-tarsus, and one erect, curved, spatulate, tenent hair. Claws with two lateral and two very small and indistinct inner teeth. Empodial appendage lanceolate and little shorter than the claw (Pl. II. fig. 14).

Head and body with sparsely scattered, ciliated, clubbed hairs, which are erect and especially long on the dorsal portions of the abdominal segments, elongating towards the abdominal segment iv, where several occur reaching to five-sixths the length of that segment, but neither strongly clubbed nor strongly ciliated. Bothriotricha very long and prominent on the abdominal segments ii., iii., and iv.

Size less than 1 mm.

*Locality.* Under a stone, Umkomaas, Natal, 16. vii. 1917.

The single specimen was associated with *Atelura natalensis*, hence may possibly be derived from the nest of an ant, which may account for the very long and erect dorsal hairs and bothriotricha. The small size, short antennæ, form of the eyes, and the character of the dorsal hairs will distinguish this species from the Palearctic species *E. lanuginosa*, Nic., which it resembles in general body-colour.

Genus *CYPHODERUS*, Nicolet.*Cyphoderus buxtoni*, Brown.

*Cyphoderus buxtoni*, Brown, 1920, Ann. & Mag. Nat. Hist. (9) vol. vi. p. 480.

This species was described previously (*loc. cit.*) from specimens in this collection.

*Locality.* Sierra Leone, in the nest of the termite, *Eutermes suspensus*, Silv., 19. vi. 1917.

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## EXPLANATION OF THE PLATES.

## PLATE II.

Figs. 1-9. *Atelura natalensis*, sp. n.

- Fig.* 1. Posterior abdominal sternites of the female.  $\times 24$ . 1 a. Apex of posterior gonapophysis.
- Fig.* 2. Posterior abdominal sternites of the male.  $\times 24$ .
- Fig.* 3. Tergites viii.-x.  $\times 24$ .
- Fig.* 4. Dorsal scale and macrochætæ.  $\times 400$ .
- Fig.* 5. Apex of galea (a) and of the terminal segment of maxillary palp (b), showing sensory structures.  $\times 280$ .
- Fig.* 6. Labial palp.  $\times 40$ .
- Fig.* 7. Terminal portion of leg.  $\times 160$ .
- Fig.* 8. Apex of style 9.  $\times 100$ .
- Fig.* 9. Basal portion of male cercus.  $\times 160$ .

Figs. 10-12. *Lepidospora neglecta*, sp. n.

*Fig. 10.* Portions of antenna. Third segment (a). A median segment (b).  $\times 100$ .

*Fig. 11.* Terminal portion of labial palp.  $\times 40$ .

*Fig. 12.* Terminal portion of leg.  $\times 160$ .

Figs. 13-14. *Entomobrya minima*, sp. n.

*Fig. 13.* Eyes of the right side.  $\times 400$ .

*Fig. 14.* Apex of leg.  $\times 400$ .

### PLATE III.

Figs. 1-8. *Machilis africanus*, sp. n.

*Fig. 1.* Posterior abdominal sternites of the female.  $\times 24$ . 1 a & b. Apices of gonapophyses.

*Fig. 2.* Urosternite 5.  $\times 24$ .

*Fig. 3.* Eyes and ocelli.  $\times 20$ .

*Fig. 4.* Maxilla, external and internal lobes, and palp.  $\times 24$ .

*Fig. 5.* Apex of terminal segment of maxillary palp.  $\times 160$ .

*Fig. 6.* Terminal segment of labial palp.  $\times 160$ .

*Fig. 7.* Teeth of mandible.  $\times 160$ .

*Fig. 8.* Apex of style 9.  $\times 100$ .

Figs. 9-11. *Lepidospora neglecta*, sp. n.

*Fig. 9.* Posterior abdominal sternites of the female.  $\times 24$ . 9 a. Apex of posterior gonapophysis.

*Fig. 10.* Tergite x.  $\times 24$ .

*Fig. 11.* Apex of galea (b) and of maxillary palp (a).  $\times 160$ .

## VI.—*Stelletta purpurca*, Ridley, and its Variations.

By MAURICE BURTON, M.Sc.

A FEW years ago I had occasion to examine a small collection of sponges belonging to the genus *Stelletta*, collected by Dr. Ondaatje at Point Galle, Ceylon, and deposited in the British Museum. From the resemblance in external form and general appearance, and from the types of spicules of which the skeleton was composed, there could be little doubt that they all belonged to one and the same species, yet the difference in size and relative proportions of the spicules was such as to make it possible to distribute them among several previously-recognised species. During the course of my observations, it became apparent that, contained in our literature, we have records of some twenty species and varieties in which the skeleton is composed of the same elements as that of the Point Galle specimens—viz., oxea, orthotriænes, anatriænes, and

tylasters. From this I started on a comparative study of these species extending over a large number of specimens, including most of the type-specimens together with many hitherto unidentified, in order to investigate how far the differences in colour, external form, and dimensions of spicules, features hitherto used as a basis for specific distinction, could be regarded as factors of taxonomic importance. My researches led me to conclude that no logical distinction could be made between the various species, and that they were but varieties of a single species, which, by priority, must be called *Stelletta purpurea*, Ridley, as shown in the synonymic list below. Since that time, I have paid particular attention to variations in sponges and find no reason for doubting my original conclusions concerning *S. purpurea* as here understood.

Drastic as this step at first appeared to me, I now see that the variations in this species are by no means so extensive as those I have witnessed in upwards of a score of other species belonging to both the genus *Stelletta* itself and to other widely separated genera. This study must be regarded, then, as on a parallel with Vosmaer's (1911 A) account of *Spirastrella purpurea* (Lamarck), and if my discussions of the various characters of *Stelletta purpurea* and their variability be meagre, it is because I feel that a detailed discussion would be redundant, since Vosmaer has so exhaustively dealt with a similar example.

#### SYNONYMY.

- Stelletta purpurea*, Ridley, 1884 c.
- Stelletta purpurea*, var. *retroflexa*, Ridley, 1884 c.
- Stelletta purpurea*, var. *parvistella*, Ridley, 1884 c.
- Myriastrea simplicifurca*, Sollas, 1886 c, 1888 B.
- Pilochrota purpurea*, Sollas, 1886 c, 1888 B.
- Pilochrota purpurea*, var. *longancora*, Sollas, 1888 B.
- Pilochrota purpurea*, var. *parvistella*, Sollas, 1888 B.
- Pilochrota hækeli*, Sollas, 1886 c, 1888 B.
- Pilochrota cingalensis*, Sollas, 1888 B.
- Pilochrota lendenfeldi*, Sollas, 1888 B.
- Stelletta reniformis*, Kieschnick, 1896, 1900.
- Pilochrota brevidens*, Topsent, 1897 A.
- Stelletta simplicifurca*, Lindgren, 1897 A, 1898.
- Stelletta inconspicua*, Thiele, 1898 A.
- Stelletta simplicifurca*, Kirkpatrick, 1900 A.
- Stelletta ternatensis*, Thiele, 1900 A.
- Stelletta brunnea*, Thiele, 1900 A.
- Stelletta renilla*, Lendenfeld, 1903 B.
- Pilochrota hækeli*, Dendy, 1905 A.
- Pilochrota hornelli*, Dendy, 1905 A.
- Stelletta bougainvillea*, Lendenfeld, 1906 A.

*Stelletta dolabra*, Lendenfeld, 1906 A.

*Stelletta nereis*, Lendenfeld, 1906 A.

*Stelletta tuberosa*, Hentschel, 1909 A.

*Stelletta purpurea*, var. *grisea*, Hentschel, 1909 A.

*Pilechrota parva*, Row, 1911 A.

*Stelletta brunnea*, Hentschel, 1912 A.

*Stelletta tuber*, Hentschel, 1912 A.

*Stelletta pilula*, et varr., Lebwohl, 1914 B.

*Myriastra parva*, Dendy, 1916 C.

*Myriastra hækeli*, Dendy, 1916 C.

(Also *vide* Lendenfeld, 1903 B, for further references)

**Diagnosis.**—Sponge usually more or less spherical, but shape variable. Colour ranging from pale yellow to purple. Skeleton, typically radial, composed of large oxea,  $\cdot 950\text{--}3\cdot 70 \times \cdot 012\text{--}060$  mm.; small ectosomal oxea,  $\cdot 102\text{--}390 \times \cdot 001\text{--}010$  mm.; orthotriænes, shaft  $1\cdot 0\text{--}3\cdot 6 \times \cdot 015\text{--}120$  mm., cladi,  $\cdot 070\text{--}366$  mm. long; anatriænes, shaft  $1\cdot 0\text{--}3\cdot 5 \times \cdot 009\text{--}060$  mm., cladi,  $\cdot 040\text{--}190$  mm. long; tylasters,  $\cdot 006\text{--}025$  mm. in diam.

A survey of the literature dealing with the 24 so-called species and varieties included in the synonymy list above is sufficient to show that they are all exceedingly closely related. Indeed, the various authors quoted have insisted on this close relationship to such an extent that a mere perusal of their works, together with a comparison of the salient features of the species involved, leaves one convinced that we are dealing not with several species but with one widely distributed species of which the numerous so-called species and varieties are but an expression of the normal variations found in sponges. What other evidence can be brought forward to support such a conviction? This may, perhaps, be best dealt with by taking the various characters, one by one, selected by the several authors for the purpose of defining species or varieties.

In more than one instance, among the species under discussion, the colour of the sponge has been used as a means of distinction. Now, this feature is most variable, as anyone familiar with sponge-collections or with the sponge-literature will realise, and, be the significance of colour what it may, it is of doubtful value in the establishing of a species. The matter seems almost too obvious to need elaboration. To me, it appears that colour-differences in sponges may be attributed to one or more of the following:—difference in age, sexual phases, presence or absence of certain chemical substances in the surrounding water, symbiotic algæ, normal fluctuating variations or mode of preservation, the last-named applying only in those cases where records of

colour in the living state are not available, a condition obtaining in most collections. Crozier (1918) has recorded seasonal colour-changes in *Donatia*. Every spongologist must be familiar with the varied hues of our common *Halichondria panicea*. Again, sponges, like seaweeds, are specially selective to iodine, and it may be that we must look to this selective power for, at least, a partial explanation of this feature. At all events, the two examples, quoted from an almost endless number available, are sufficient to show the relatively small value of this character to the systematist. If anything further need be said on the question of colour, it is this, that among the various specimens in the British Museum Collection identified by Ridley and referred to *Stelletta purpurea* the colour varies from white to brown or a very pale purple. The same may be said of the various examples of *Stelletta simplicifurca*, identified by Sollas and Kirkpatrick, and of *Stelletta hæckeli*, identified by Sollas and Dendy. Clearly these authors did not regard colour as of primary importance in this species.

The external form of sponges, again, is anything but constant, particularly in those forms whose skeleton is built up to a greater or lesser extent of spongin. In the genus *Stelletta* variation of form is confined to fairly narrow limits. As in all sponges where the skeleton is composed of long spicules arranged radially it is primarily spherical and the modifications are but derivatives of this simple ground-form, as mammilliform, pyriform, calyciform, or even massive and irregular. I have seen this strikingly well shown in a series of specimens of *Stelletta communis* (Sollas), to mention but one example, which ranged from spherical to mammilliform, on the one hand, and to pyriform, on the other.

The pores are confined to pore-areas, and call for no comment. The oscules are subject to some variation from specimen to specimen. Of late, I have made fairly extensive observations on the exhalant apertures in different genera of sponges concerning which I hope to say more at some future date. For the present it will suffice to say that the various forms of arrangement of the exhalant apertures, described under the various so-called species here discussed, do occur among the individuals of a single species and that no obstacle is met with, as regards this feature of sponge morphology, when endeavouring to justify the above list of synonyms of *S. purpurea*. One example will serve to illustrate. In a group of specimens of *Ecionemia robusta* (Ctr.) from Port Phillip Heads, Australia, the oscules were



for the most part scattered, usually level with the surface, sometimes not apparent, while in one case, a particularly fine specimen, only a single apical osculum was present leading into a deep cloaca. The diameter of these openings varied considerably.

The variation in the character of the cortex of any Stellettid species is considerable and may be easily demonstrated, and the abandonment of the genera *Myriastru* and *Pilochrota*, on these grounds, has been taken for granted by recent authors.

The last point concerns the size and shape of the spicules. Sollas (1888 B), Hentschel (1912 A), and Topsent (1922 B) in *Stelletta communis*, *S. clavosa*, and *S. crassispicula*, respectively, have shown how much these characters may differ in different individuals of a single species. Further, in a group of specimens from one and the same locality, Pt. Galle, Ceylon, as mentioned above, I have been able to observe variations in spicular dimensions such as have led previous writers to the formation of a new variety or even species. Yet these specimens were obviously co-specific. Again, in the specimens of *S. haeckeli*, described at various times by Dendy, to take but two features, the cladi of the orthotriænes ranged from .180–.360 mm. and of the anatriænes from .036–.126 mm. Also the angles made by the cladi with the rhabdomes were of an almost infinite variety. In *Stelletta simplicifurca* (Sollas), too, the spicular dimensions recorded to date are sufficient to embrace those of all the related species here dealt with.

Small oxea appear to form a normal constituent of the spiculation, but they are sometimes present in such small quantities that their presence is apt to be overlooked.

In *Stelletta nereis* Lendenfeld emphasizes the fact that the chiasters are acanthtylasters. He appears to be "making a mountain out of a mole-hill." The chiasters of *Stelletta* and other allied genera will frequently be seen to bear small spines when examined with an oil-immersion lens. Just as in the anthasters of Sollas's now-abandoned genus *Anthastra* and in the microrhabds of *Ecionemia* the degree of spining may vary considerably in a single species, so in the chiasters of species of *Stelletta* the rays may or may not bear spines, and the presence or absence of these excrescences is of little value for taxonomic purposes.

*Stelletta brevidens* (Topsent) is obviously only an immature specimen of *S. purpurea*, Ridley, as here understood.

*Distribution*.—Red Sea, Indian Ocean, Indo-Pacific and Japanese Seas, Australasia.

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VII.—*Coleoptera from the Seychelles and adjacent Islands*: Carabidæ (*Supplement*), Cryptophagidæ (*Supplement*), Dermestidæ, Lymexylonidæ, Rhipiceridæ, Sphindidæ, Throscidæ, Brenthidæ. By HUGH SCOTT, M.A., Sc.D., F.E.S., Curator in Entomology, University Museum of Zoology, Cambridge.

THE purpose of this paper is to report on certain small groups of the Coleoptera obtained by the Percy Sladen Trust Expedition to the Indian Ocean under Professor J. Stanley Gardiner in 1905 and 1908-9. Of most of the families dealt with, no account has previously appeared in the published results of the Expedition, but supplements are also included here to two families which have been already reviewed. The supplement to CRYPTOPHAGIDÆ contains a description of a new species from South America, which is published here because the species belongs to a new genus, the only other known representative of which was taken in the Seychelles.

The types of the new species, with a set of the material from the Indian Ocean, will be placed in the British Museum; but the type of the South American species, *Eurycratus cochabambæ*, is in the Paris Museum.

The drawings have all been made by myself, with the aid of a drawing apparatus.

In the lists of localities, when no collector's name is given after data relating to specimens taken in the Seychelles in 1908 or 1909, it is signified that these were collected by myself or by friends working in company with me at the time.

Some brief notes on bionomics and on variation in size will be found under *Callirrhapis philiberti* (RHIPICERIDÆ) and *Melittomma insulare* (LYMEXYLONIDÆ). The geographical distribution of the genera and species dealt with is also discussed under most of the families. It may be remarked here that the occurrence in the Seychelles of any representatives at all of the family SPHINDIDÆ is of very considerable interest.

#### Carabidæ (Supplement).

This family was dealt with in my report on the Adephaga of the Percy Sladen Trust Expedition, *Trans. Linn. Soc. ser. 2, Zool. xv. pp. 239-261 (1912)*. The following addenda have since come to hand:—

#### *Perigona nigriceps*, Dejean.

This almost cosmopolitan species must be added to the

list of the Carabid fauna of the islands, a single example having been found with other material (in a tube of spirit) from Cerf Island, Providence, Farquhar Group, 3. x. 1905. It was determined by Mr. H. E. Andrewes, who has dealt with the synonymy of the species in Trans. Ent. Soc. London, 1919, p. 181.

*Acupalpus* sp.

This was included, on p. 252 of my report cited above, as "Carabid. gen. et sp. indet.," the absence of the head in the single example having made it impossible for me to determine the species. Mr. Andrewes thinks that it belongs to the genus *Acupalpus*, and is close to an unnamed tropical African species in the British Museum. He writes (letter, 24. x. 1923) that he knows of no member of this genus from Madagascar. The genus finds no place in Alluaud's 'Liste des Coléoptères de la Région Malgache' (1900). The specimen under discussion is from Aldabra.

*Tachys seychellarum*, Scott, *op. cit.* p. 250, pl. xii. fig. 13.

Mr. Andrewes tells me that, so far as he can see from a superficial examination of the unique type, this species is very close to, but distinct from, *T. brevicornis*, Chaud. (*minutissima*, Motsch.; *atomaria*, Woll.; etc.), a species widely distributed in Europe, Asia, Africa, and possibly America. He thinks that it is also distinct from any of the Oriental species (which he has recently revised, Ann. Mus. Civ. Genova, li. 1925, pp. 327-502, pls. iii.-iv.), though near to some of them; while with the African forms known to him it does not appear to correspond.

**Cryptophagidæ (Supplement).**

The Cryptophagidæ of the Percy Sladen Trust Expedition were dealt with by the late Mons. Antoine Grouvelle in his report on the Cucujidæ and Cryptophagidæ, Trans. Linn. Soc. London, ser. 2, Zool. xvii. pp. 142 & 154-156 (1914). This supplement is added for the purpose of proposing a new genus to include a species which, owing to its belonging to a rather aberrant series of forms, I did not previously recognize as a member of this family, and which was consequently never submitted to Mons. Grouvelle. At the same time there is included a description of a second species of the same new genus, based on a previously undescribed specimen, not from the Seychelles, but from South America. The matter is further explained below, in the remarks under the new genus.

Yet another species, represented by a single very minute insect from Silhouette, Seychelles, and apparently referable to this family (though to a different section of it), must remain for the present undescribed.

*EURYCRATUS* \*, gen. nov.

Corpus glabrum, nitidum, elongatum, angustum, lateribus parallelis, postice obtuse rotundatum. Caput conspicue latum, ante oculos breve, margine anteriore truncatum vel sinuatum. Antennæ 11-segmentatæ, sat robustæ, clavâ triarticulatâ haud abrupta. Prothorax angustum, longius quam latus, basi et lateribus marginatis. Elytra seriatim punctata, striâ subsuturali antice plus minusve obsoletâ. Prosternum longum, suturis lateralibus profundis ac integris, processu intercoxali angusto. Coxæ anticæ globulares, acetabulis postico oclusis. Segmenta ventralia abdominalia 5, de antico ad posticum perparum abbreviata. Tibiæ omnes ad apicem valde dilatatæ, extus productæ, apice spinosæ. Tarsi in ♂ et in ♀ heteromeri, antici et medii 5-segmentati, postici 4-segmentati: segmentis basalibus robustis, subtus setosis, segmento penultimo minuto, segmento terminali omnibus aliis simul sumptis longiore, basi tenui, apice dilatato.

Body glabrous and shining, long, narrow and parallel-sided, bluntly rounded at the hind end. *Head* remarkably broad, at the level of the eyes as wide as the widest part of the prothorax; very broad and short in front of the eyes, the suture separating clypeus from frons being either altogether obliterated or represented only by obsolete traces; front margin truncate or sinuate in the middle, though this is not always visible from above, owing to the downward slope of the front part of the head. *Antennæ* inserted in front of the eyes, under the margins of the head; 11-segmented, rather stout, segment 3 about  $1\frac{1}{2}$  times as long as broad, segments 4-8 more or less short, 9-11 forming a not very broad nor very abruptly demarcated club. *Labrum* apparently freely movable, but concealed beneath the front margin of the head. *Mandibles* projecting, with two teeth visible at the apex. *Maxillary* and *labial palpi* with terminal segment simple, obliquely truncate at the apex. *Prothorax* in both the known species longer than broad, narrowing towards the base, margined at the sides and behind, though the lateral margins are not visible from above towards the front angles; in side view the deflexed front and hind angles are seen to be widely rounded off. *Scutellum* broader than long. *Elytra* with seriate punctuation, and each with a

\* From *εὐρύς*, broad, and *ὁ κρᾶς* (genitive *κρᾶρός*), the head.

single subsutural stria more or less developed in the posterior part. *Hind wings* fully developed, considerably longer than the elytra. *Prosternum* long, with the sutures on either side deep and complete; intercoxal process narrow, much narrower than either of the globular *front coxæ*, broadening somewhat behind the coxæ, bent up and truncate at the extremity; the side-pieces of the prothorax appear to reach, even if they do not actually touch, the intercoxal process, and the acetabula may therefore be regarded as virtually closed behind. *Mesosternum* rather long; *middle coxæ* also small and globular, separated only by a very narrow process of the mesosternum; the sutures delimiting the side-pieces are almost entirely obsolete, but as far as can be made out the epimeron is a short, obliquely transverse piece, becoming even shorter towards its inner extremity, while neither it nor the episternum reach the middle coxal acetabula, a broad strip of the mesosternum interposing (cf. Sharp, original description of *Trogocryptus*). *Metasternum* long; its episterna extend throughout its whole length, and are narrow, and narrowing slightly towards the hind end; the epimera appear to be two very short transverse pieces, one on either side in front of the hind coxa, and dwindling almost to a point at the inner extremity; *hind coxæ* very narrowly separated, transverse, extending to the outer margin of the metasternum. Visible *ventral abdominal segments* 5, segment 2 only very little shorter than 1, 3 and 4 almost equal in length and a little shorter than 2, 5 rather shorter than 4. *Tibiæ* markedly dilated, outwardly produced and spinose at the apex. Tarsi heteromerous in both sexes, the formula being 5, 5, 4; segments 1-3 in the front and middle pairs, or 1 and 2 in the hind pair, are stout, bearing stiff hairs beneath; the basal segment is about as long as (or, in the hind tarsi, possibly longer than) the second and third segments together; penultimate segment minute and slender; terminal segment longer than all the preceding segments together, slender at the base, dilated towards the extremity.

*Ædeagus*: this organ is described under *E. cochabambæ*.

Type of the genus: *Eurycratus laticaput*, sp. n. (Seychelles).

This genus is erected primarily to include a single specimen from Mahé, Seychelles, which I have previously described, without naming it, and which I then referred to CUCUJIDÆ. Mr. Arrow and Mr. Champion have since drawn my attention to the fact that the insect belongs not to CUCUJIDÆ, but apparently to a group of genera, with heteromerous tarsi, usually placed in CRYPTOPHAGIDÆ. Moreover, while working

in the Paris Museum in 1924, I found in the Grouvelle Collection a single unnamed specimen of a second species of the new genus at present under review; this specimen was borrowed, and is here described. It had apparently puzzled the late Mons. Antoine Grouvelle, as it was placed quite out of the regular order in one of his boxes, and bore a manuscript-label in his handwriting, calling attention to certain of its structural features. This specimen (*Eurycratus cochabambæ*) is from Bolivia; four of the genera of the group to which I believe the new genus to be allied are from Central America, while a fifth has been recently described from India; and it is possible that *Eurycratus laticaput* is not really a native of the Seychelles, but is imported.

Of the genera to which *Eurycratus* appears to be allied, *Holosternus*, *Anepsicus*, *Cissocryptus*, and *Trogocryptus* were described by Sharp from Central America (Biol. Centr.-Am., Col. ii. 1, pp. 599-603, March 1900). Additional remarks, in which attention was called for the first time to the heteromorous tarsi (which were erroneously described by Sharp as all 5-segmented) were made by Champion in 1913 (Trans. Ent. Soc. pp. 91-94); and the latter writer has subsequently described (Ent. Mo. Mag. lx. 1924, pp. 167, 168) a further genus, *Trogocryptoides*, belonging to the same group, from the Kumaon Himalayas. There are also, in the British Museum, unnamed examples from South Africa of two species which belong either to one of the above-named genera or to an undescribed genus of the same group.

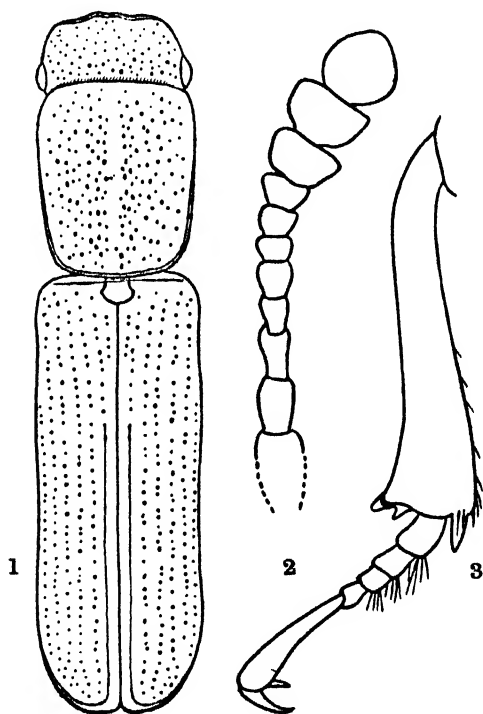
*Eurycratus* differs from all the other genera in its long narrow form, in having the prothorax longer than wide and the antennal club a trifle less abruptly demarcated, in the relatively greater length of the ventral abdominal segments and the very slight difference in length between the second and the first, and above all in the great breadth of the head: this last is its most characteristic feature, since in all the other genera the head is by comparison more or less narrow and produced in front of the eyes. *Eurycratus* approaches *Trogocryptus* in having the prosternal sutures deep and complete, the apices of the tibiae dilated, the prosternal intercoxal process narrow, and the anterior acetabula virtually closed behind. *Anepsicus* also has the prosternal sutures deep and complete, the intercoxal process narrow, and the acetabula virtually closed, but the tibiae are not dilated at the apex. *Holosternus*, *Cissocryptus*, and *Trogocryptoides* differ from *Eurycratus* still more widely, having the prosternal sutures more or less obliterated, the intercoxal process broader, and the acetabula narrowly open behind. Out of the whole group, the genus

which *Eurycratus* most nearly approaches is Central American. The form of *Eurycratus* is so characteristic that I have no hesitation in erecting the genus, though on only two specimens ; and these latter are so distinct one from the other that they may justifiably be described as two distinct species.

*Eurycratus laticaput*, sp. n.

"Genus et Species?" [CUCUJIDÆ], Scott, Trans. Linn. Soc. London, ser. 2, Zool. xviii. p. 244 (1922).

It is unnecessary to repeat here the full description given under the above reference. The sex of the individual (♀)



Figs. 1-3.—*Eurycratus laticaput*, ♀.

1, whole insect,  $\times 24$ ; 2, antenna from beneath,  $\times 100$ ; 3, inner face of right front leg (from in front),  $\times 100$ . All from the dried carded specimen.

has since been proved by dissection ; the hind wings have also been examined and found to be fully developed. If the



specimen be tilted steeply upwards, an obsolete trace of the suture separating the clypeus can be seen on either side, extending obliquely inwards and backwards from the front angle of the head. The antennæ are relatively a little more slender, and have the club consequently a little more abruptly marked off, than in *E. cochabambæ*; also segment 4 is a little longer in proportion to its width (see fig. 2). The difference in the form of the scutellum in the two species is not as great as it appears in figs. 2 and 5; its greater length, and the narrowing of the sides towards the base, shown in fig. 1, is due, in part at least, to the prothorax being pulled further forward in the specimen of *E. laticaput*. The sub-sutural stria is recurved at the apex and continued round the hind margin of the elytron, as shown in the figure. The progressive shortening of the abdominal sternites is very little in this species; sternites 2-5 have each a regular series of short wrinkles extending right across the sternite at its extreme base. Length of the specimen about 3.9 mm.

*Loc.* Seychelles. Mahé: Cascade Estate, about 800 feet or over, between Oct. 1908 and Jan. 1909, 1 ♀. I have no recollection whether the specimen was found in the plantation or in the native forest.

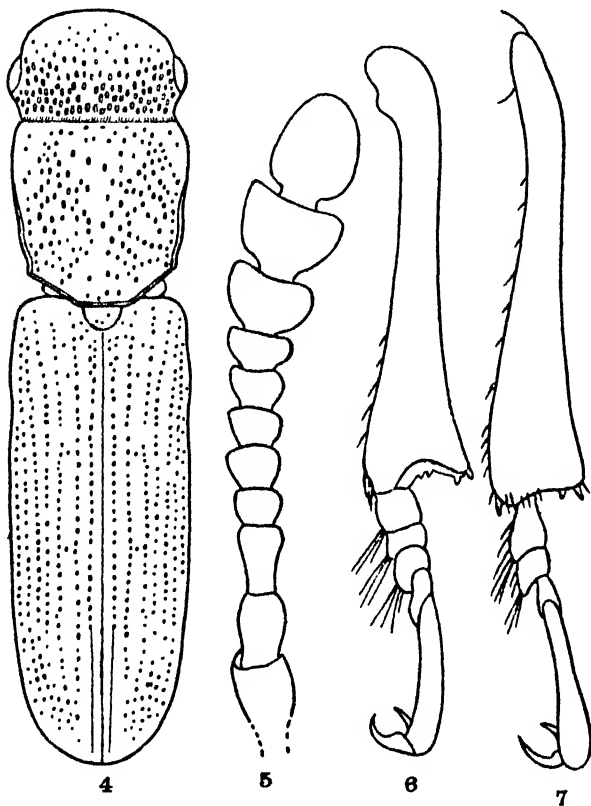
*Eurycratus cochabambæ*, sp. n.

♂. Major; capite post oculos longiore, margine anteriore in medio truncato, in latere utroque arcuato, superficie postice fortiter sat dense punctatâ, punctis elongatis, antice subtilius punctatâ; prothorace vix longiore quam latiore, angulis posticis (desuper visis) acutis, lateribus ante angulos posticos bisinuatis, basi in medio truncatâ, in latere utroque oblique ad angulum posticum extensâ, disco punctis fortibus, elongatis, haud densis munito; elytris striâ subsuturali solum in tertiâ parte posteriore longitudinis visibili, intervallis impunctatis.

Long. corp. ca. 4.1 mm.

Larger than *E. laticaput*, differently shaped, and less blackish; head, prothorax, and apical part of the elytra pitchy-reddish, remainder of elytra darker, but not so black as the colour of *E. laticaput*. Head longer than that of *E. laticaput*, a considerable space, in which the breadth diminishes gradually backwards, intervening between the eyes and the front of the prothorax; the front margin is truncate (not sinuate) in the middle, and arcuate (not sinuate) on either side (from above it appears widely arcuate throughout, as shown in fig. 4); the surface is covered with large, deep, elongate punctures behind and

with finer punctures in front, and there is no indication of any suture separating the clypeus. *Antennæ* relatively a little stouter, club less abruptly demarcated, fourth segment very short. *Prothorax* only a very small fraction longer than broad; when it is viewed from above the hind angles appear sharp, and the sides bisinuate just in front of them,



Figs. 4-7.—*Eurycratus cochabamba*, ♂.

4, whole insect,  $\times 24$ ; 5, antenna from beneath,  $\times 100$ ; 6, inner face of left front leg (from in front),  $\times 100$ ; 7, inner face of right hind leg,  $\times 100$ . All from the dried carded specimen.

as in fig. 4; the base is truncate in the middle, and slants rather sharply forward to the angle on either side; the reflexed margin is less distinct along the truncate middle part than on either side; the surface bears large elongate punctures, which are not very close, and finer punctures near the front

margin, while the middle line is impunctate. *Elytra* a little less bluntly rounded at the hind end than in *E. laticaput*; the subsutural stria is only discernible in about the posterior third of the length of the elytra, extending much less far forward than in *E. laticaput*, and is less distinctly recurved round the hind margin; the seriate punctures are considerably smaller than the punctures on the prothorax, and those in each series are from one to about three times their own diameter apart; intervals quite smooth and flat, and almost entirely impunctate (about four punctures are visible in the third interval from the suture on either elytron). *Hind wings* fully developed. *Pro- and meso-sterna* and their side-pieces strongly and fairly closely punctured, the punctures much scantier on the middle part of the prosternum in front of the coxæ. *Meta-episterna* strongly punctured, *metasternum* with strong large punctures at the sides, almost impunctate in the middle. *Abdominal sternites* 1 and 2 with large shallow punctures at the sides, nearly impunctate in the middle; 3-5 with punctuation finer and extending more evenly across each segment, especially towards the base; the gradual diminution in length of the sternites is more marked in this than in the preceding species. Basal segments of *front* and *middle tarsi* relatively a little stouter than in *E. laticaput*; this may be a character of the ♂.

*Ædeagus* (fig. 8): judging by the form of its parts, the aspect of this organ shown in the figure is almost certainly dorsal, but I was unable to note how the organ lay in the body of the beetle, and, since there is but a single example, this point cannot be further investigated. The lateral lobes (*l.l.*) bear long hairs at the apex and on the side-margin dorsally, and on the ventral surface minute tubercles ending in very short minute hairs\*; the median lobe (*m.l.*) appears to be in its apical portion very weakly chitinized and twisted over; the basal piece (*b.p.*) is incomplete (or, at any rate, represented by transparent invisible membrane) over a large part of its dorsal surface, and the apical marginal parts of its chitinized portion are clothed with fine short hairs; the course of the internal sac (*i.s.*) can be traced, and its walls also bear fine hairs; at its distal extremity on either side is a transparent chitinous piece bearing a number of minute circles each with a dot (but no hair) in the centre; these chitinous pieces rise from what I take to be the basal part of the median lobe, and they lie dorsal to the base of the lateral lobe on either side; projecting dorsally from

\* These minute tubercles are shown in the figure, as they are visible from above through the transparent chitin of the lateral lobes.

the basal portion of the ædeagus is a long curved chitinous structure (*i.s.* (?)), blunt at the extremity, which is apparently a chitinized part of the internal sac extending outside the tegmen; it lies twisted to the right-hand side, but this may be an accident of the preparation; its chitin is almost colourless, except for a brownish-yellow thickened portion,

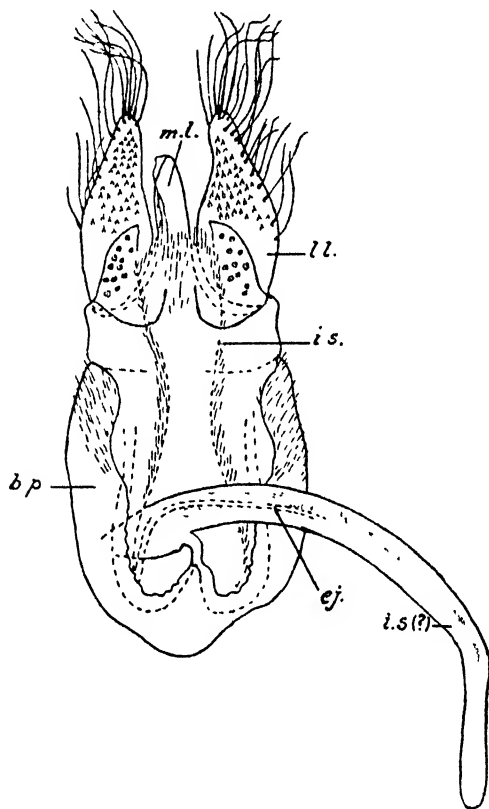


Fig. 8.—*Eurycratus cochabambæ*, ædeagus,  $\times$  ca. 170.

*b.p.*, basal piece; *ej.*, ejaculatory duct; *i.s.*, internal sac; *i.s.* (?), chitinized portion of internal sac extending outside tegmen (?); *l.l.*, lateral lobe; *m.l.*, part of median lobe.

represented by fine dotted shading in the figure; a narrow ejaculatory duct (*ej.*) can be traced along the basal part of this chitinous prolongation of the sac, but I have been unable to discern it in the distal part.

No attempt is made here to deduce the affinities of this

genus from the structure of the ædeagus. Such a deduction would involve an examination of the male armature in a series of neighbouring genera, and probably in others more distantly allied, a task which I have at present no opportunity to undertake. It may be remarked, however, that the only armature of a Cryptophagid described by Sharp and Muir in their work on "The comparative anatomy of the male genital tube in Coleoptera," namely that of *Antherophagus nigricornis*, F., while differing much from that of *Eurycratus cochabambæ* in other respects, appears to have a long external chitinized extension of the internal sac, the apex of which was broken off and consequently not examined (Tr. Ent. Soc. London, 1912, p. 522, pl. lix. fig. 105).

*Loc.* Bolivia : Cochabamba, 1 ♂.

*Type* in the Paris Museum (Collection Antoine Grouvelle).

#### Dermestidæ.

This family is represented in the collections of the Percy Sladen Trust Expedition by five species belonging to four genera; two of the species are cosmopolitan, and two others are very widespread. For the fifth, which appears to be new, it has been necessary to erect a new genus; this insect may possibly form part of the endemic fauna of the Seychelles, but this is open to doubt.

#### DERMESTES, L.

*Dermestes cadaverinus*, F. ; Kolbe, Mitt. Zool. Mus.

Berlin, v. 1910, p. 24.

A cosmopolitan species.

*Loc.* Cargados Is., Farquhar Group, Aldabra, Amirantes, Seychelles.

Cargados Is.: Siren I. and Establishment I., 1905, 30 specimens. Farquhar Group: Providence, Cerf I., 1905, 12 specimens. Aldabra: Takamaka, x.-xii. 1908, and Picard I., i. 1909, 16 examples (*Fryer*). Amirantes: Eagle I., 1905, 6 specimens. Seychelles: Bird I., vii. 1908, 1 example (*Fryer*): Mahé; 3 specimens, including one from Cascade Estate, 800 feet or above, ii. 1909; also Mamelles Plantation (*A. Brauer*, teste Kolbe, l. c.).

#### *Dermestes vulpinus*, F.

Also cosmopolitan, but obtained by the Expedition only from Aldabra and the adjacent islands.

*Loc.* Aldabra, Cosmoledo, Assumption.

Aldabra : Ile Michel, x. 1908, 12 examples (*Fryer*). Cosmoledo : 1907, 2 examples (*Thomasset*). Assumption : 3 adults and 6 larvæ found on dead turtle, 1909 (*R. P. Dupont*).

ORPHINUS, Motschulsky.

*Orphinus brevicornis* (Sharp).

*Cryptorhopalum brevicorne*, Sharp, Tr. R. Dublin Soc. iii. 1885, p. 150; id., Fauna Hawaiiensis, iii. part v. 1908, p. 413; Dalla Torre, Coleopt. Cat. part 33, 1911, p. 73.

*Orphinus brevicornis*, Arrow, Ann. & Mag. Nat. Hist. (8) xv. 1915, p. 438.

*Trogoderma unicolor*, Kolbe, Mitt. Zool. Mus. Berlin, v. 1910, p. 24.

I had determined the series of this species from the Seychelles, by means of Kolbe's description, as *Trogoderma unicolor*, but subsequently Mr. Arrow drew my attention to its identity with *Cryptorhopalum brevicorne*, Sharp, a fact of which I satisfied myself by a careful comparison with the types and other examples out of the original series. I then found in the British Museum several unnamed specimens, which after close examination I have no hesitation in referring to this species, and which make it appear that the insect occurs almost throughout the warmer parts of the world. The distribution includes the Hawaiian Islands, the Seychelles, Madagascar, Java, North Australia, and Brazil.

*Loc.* Seychelles: Silhouette, Mahé. Silhouette: Mare aux Cochons and forest immediately above, over 1000 feet, ix. 1908, 2 examples. Mahé: Cascade Estate, 800 to 1000 feet, x. 1908–ii. 1909, 6 specimens; high forest behind Trois Frères, 1500 feet or more, 14. i. 1909, 1 example; cultivated places (*A. Brauer*, teste Kolbe, *l. c.*).

Hawaiian Islands: Oahu, found in houses at Honolulu (*Blackburn*). Madagascar: several examples in the Berlin Museum (teste Kolbe, *l. c.*). Java: 1 ♀ (*Bowring*, Brit. Mus.). North Australia: Port Darwin, 1 ♂ (Brit. Mus.). Brazil: Pernambuco, 1 ♀, and Rio de Janeiro, 1 ♂ (both in the Fry Collection, Brit. Mus.).

This species exhibits considerable variation in size. In the Seychelles series the examples vary from a ♂ 1.9 mm., to a ♀ about 2.5 mm., long (these measurements do not include the head). In several of the Hawaiian specimens the whole of the antenna, including the club, is quite light yellowish, while in several of the Seychelles specimens the club is darkened.

## ATTAGENUS, Latr.

## Subgenus TELOPKS, Redtenb.

*Attagenus (Telopes) undulatus* (Motschulsky).

*Æthriostoma undulata*, Motsch., Etud. Ent. vii. 1858, p. 47, pl. i. fig. 10; Reitter, Verh. Nat. Ver. Brunn, xix. 1880, p. 35 (1881); Fairmaire, Ann. Soc. Ent. Belg. xxxvii. 1893, pp. 523, 528; Alluaud, Liste Col. Région Malgache, 1900, p. 224; Dalla Torre, Coleopt. Cat. part 33, 1911, p. 60.

*Attagenus (Telopes) undulatus*, Arrow, Ann. & Mag. Nat. Hist. (8) xv. p. 426 (1915).

*Attagenus rufipes*, Walker, Ann. & Mag. Nat. Hist. (3) iii. 1859, p. 53; Dalla Torre, *op. cit.* p. 57.

*Brachysphyrus irroratus*, Blackburn, Trans. R. Soc. S. Austral. xxvii. 1903, p. 160; Dalla Torre, *op. cit.* p. 71.

*Loc.* Seychelles, Amirantes; the further distribution is given below.

Seychelles: Silhouette, Mahé. Silhouette: viii. 1908, 1 example. Mahé: Cascade Estate, 800–1000 feet, x. 1908–iii. 1909, 22 specimens. Amirantes: Desroches I., 1905, 3 examples.

The distribution includes India, Ceylon, Singapore, Hongkong, Sumatra, Philippine Is., North Queensland, Zanzibar, Madagascar, Mauritius, Réunion, Comoro Is., Amirantes, and Seychelles. A number of these countries are listed by Arrow (*l. c.*), while I saw in the Paris Museum (iii. 1924) a long series from Mauritius (*d'Emmerez*); several from Madagascar, Audevorante (*A. Mathiaux*, 1899), and Nossi-Bé (*H. Pierron*, 1885); specimens in A. Grouvelle's collection from Zanzibar, Singapore, and Sumatra (P'alem-bang); and the examples from the Comoros, Mayotte (*L. Humblot*, 1884), recorded by Alluaud (*l. c.*). Blackburn described the species from North Queensland under the name *Brachysphyrus irroratus*.

As stated by Arrow, this beetle has been found in Ceylon flying round trunks of Hog-plum trees (*Spondias mangifera*); but recent references to it in Indian entomological literature as a grain-pest are erroneous, and really indicate *Trogoderma granarium*, Everts (*khapra*, Arrow, Ann. & Mag. Nat. Hist. (8) xix. 1917, p. 481).

It is possible that *Anthrenus pustulatus*, Thunb., may have to be added to the synonymy given above; there are specimens of *Attagenus undulatus* from Réunion in A. Grouvelle's collection (Paris Museum) labelled "*pustulatus*, Thunb.," but not in Grouvelle's handwriting, and I have been unable to find out by whom. *Anthrenus pustulatus*, Thunb., was described from South Africa. The question of its identity with *Attagenus undulatus* must remain open.

## PARATROGODERMA, gen. nov.

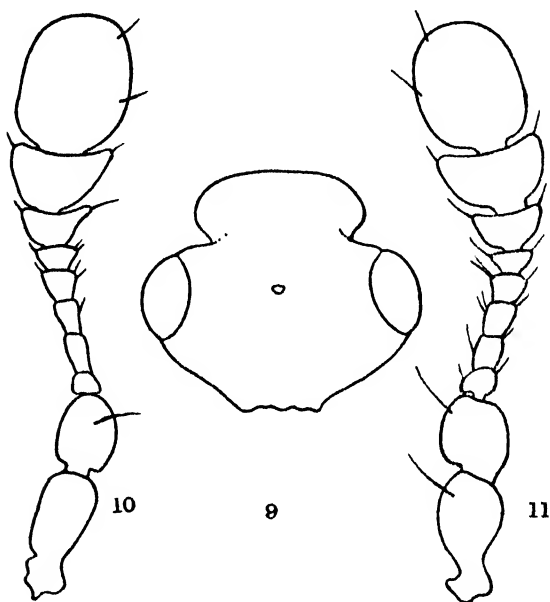
Corpus ovatum, pubescentiâ decumbente vestitum. Oculi margine inferiore nec sinuato nec emarginato. Ocellus fere obsoletus. Antennæ 10-segmentatæ, segmento 3<sup>o</sup> minuto, clavâ 3-segmentatâ. Caput ante oculos fortiter constrictum, parte anteriore magnâ, antice in medio truncatâ. Partes oris a prosterno celatæ. Mentum haud transversum, fere æque longum ac latum. Prothorax subtus utrinque fossâ sat profundâ, postice carinâ acutâ terminata, ad clavam antennæ recipiendam, munitus. Prosternum ante coxas brevissimum, processu intercoxali angusto, postice in foveam mesosterni profundam recepto. Coxæ anticæ valde transversæ. Coxæ intermediæ sat late distantes. Elytrorum epipleura solum ad coxas posteriores attingentia, postice gradatim angustata. Metasternum antice inter coxas intermedias in processum (margine late rotundato) productum, utrinque lineâ elevatâ, parum sinuata, oblique ad marginem lateralem metasterni extensâ. Meta-episterna sat parva, transversa, latere inferiore fere dimidiam metasterni longitudinem attingente, latere exteriori brevior. Meta-epimera magna, postice vix angustata. Coxæ posticæ ultra margines laterales metasterni extensæ, sed latera corporis haud attingentes; laminâ coxali in parte exteriori vix brevior quam in parte interiori. Tibiæ omnes margine superiore antico spinis tenuibus munito. Tarsi omnes 5-segmentati; intermedii et postici segmento basali et segmento 2<sup>o</sup> fere æque longis.

This genus is proposed for the reception of a single species, and is distinguished from *Trogoderma* by the following characters: (i.) the ovate form of the body; (ii.) the antennæ are 10-segmented (not 11-segmented); (iii.) the eyes are not in the least sinuate or emarginate at their inner margin; (iv.) the mentum is not short and transverse, but as long as, if not longer than, broad; (v.) the form of the side-pieces of the metasternum is quite different (see below); (vi.) the front upper edge of all the tibiæ is set with fine short spines, not very closely placed (but there is no serrate row of stout spines or teeth as in the front tibiæ, especially, of *Phradonoma villosulum*, Duftschm.); (vii.) the basal segment of the middle tarsi is a little shorter than, and that of the hind tarsi only about equal in length to, the second segment (in *Trogoderma* the basal segment is almost as long as the two following segments together).

The material is small and balsam-mounts have not been made of the mouth-parts, tarsi, or ædeagus. The following characters of the genus can, however, be added:—*Body* clothed with decumbent pubescence. *Mouth-parts*, in repose, in great part hidden by the prosternum. *Ocellus* almost obsolete, and not always easy to discern; under a high power it is seen to consist of a small impunctate area,



more shining than the surrounding closely punctate surface, but not sharply delimited, since the surrounding punctures abut on it and make its limits irregular; it is indicated in fig. 9. *Head* deeply constricted on either side in front of the eye by the antennal grooves; the large portion in front of the constriction has its margin truncate in front and curved at the sides; this anterior portion is not separated from the hind part by any suture, at most there is a vague transverse depression, only visible in certain aspects\*. The



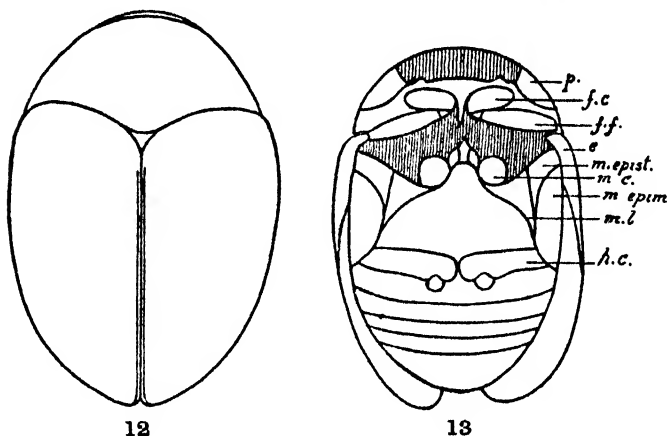
Figs. 9-11.—*Paratrogoderma mahense*.

9, head, detached, with front tilted up,  $\times 66$ ; 10, antenna of  $\sigma$ ,  $\times$  ca. 170; 11, antenna of  $\varphi$ ,  $\times$  ca. 170. 10 and 11 are from preparations in Canada Balsam.

form of the *antennæ* is shown in figs. 10 and 11. That shown in fig. 10 is taken from a specimen known to be  $\sigma$  by the *ædeagus*, which is projecting from the hind end of the body; segment 3 is very short, 4 rather long and slender,

\* Presumably the front part of this anterior portion of the head represents the labrum, but it is entirely fused with the head-capsule and no suture is visible between them. At first I thought that the labrum might be hidden beneath the margin of the anterior part of the head, but no such hidden labrum is visible.

5, 6, and 7 progressively shorter and broader, 8-10 forming the club; the antenna is only very little serrate on the inner side. That shown in fig. 11 is taken from a specimen proved by dissection of the ovipositor to be ♀; the principal difference between this antenna and that of the ♂ lies in the form of segments 4 and 5, which are considerably broader and equal in length. (Without more material I cannot be certain whether part of the difference in form is due to the figured antennæ lying in different positions in the balsam.) *Maxillary palpi* (as far as can be seen without



Figs. 12, 13 — *Paratrogoderma mahense*.

12, outline of dorsal view,  $\times 24$ ; 13, ventral view, head removed, legs (except the front femora and all the coxæ) also removed, prothorax pulled away from hind body, elytra a little opened (*p.*, pocket for reception of club of antennæ; *f.c.*, front coxa; *f.f.*, front femur; *e.*, epipleuron of elytron; *m.epist.*, meta-episternum; *m.c.*, middle coxa; *m.epim.*, meta-epimeron; *m.l.*, metasternal line; *h.c.*, hind coxa). The asymmetry of the sternal parts on the two sides is due to the impossibility of getting the specimen to lie perfectly horizontal.

dissection) with the terminal segment about as long as the preceding segments together, and truncate at the apex. *Prothorax* with lateral margins sharp, deflexed, not in the least explanate; produced into a bluntly rounded lobe in the middle of the hind margin. On the underside the concave pockets for reception of the clubs of the antennæ are bounded behind by a sharp thin ridge (as in *Trogoderma*); in the ♂ they extend back a little more than half-way between the front and hind lateral edges of the

prothorax. *Scutellum* triangular. *Elytra* with epipleura extending back as far as level with the hind coxæ, gradually narrowing off to a point. *Hind wings* fully developed. *Prosternum* forming a broad but extremely short strip in front of the coxæ (proportionately shorter and broader than in *Trogoderma versicolor*); intercoxal process forming a very narrow, nearly parallel-sided piece, tapering a little at the apex, which fits into a deep groove in the mesosternum between the middle coxæ. *Front coxæ* considerably produced in a transverse direction. The lobe of the *metasternum* which extends forwards between the middle coxæ is broadly rounded in front; there are two raised *metasternal lines*, one on either side, running obliquely backwards and outwards from behind the middle coxa to the lateral margin of the metasternum, which it touches near the hind end. *Meta-episterna* very short, but longer at the inner margin, where they run to a point, than at the outer margin. *Meta-epimera* large, four-sided, the anterior margin running obliquely inwards and backwards, the posterior margin obliquely inwards and forwards, so that the inner margin is shorter than the outer, yet even the inner margin extends forwards more than half the length of the side-margin of the metasternum (in *Trogoderma versicolor* the episternum extends the entire length of the metasternum, and the epimeron is a quite small, roughly triangular, piece). *Hind coxæ* extending outwards almost to the outer margins of the epimera (but not quite reaching the side-margin of the body), almost the same length (in an antero-posterior direction) throughout, but produced backwards a little and sinuate at the inner extremity. All the *tibiæ* without any conspicuous spine or spur at the apex. Visible *ventral abdominal segments* 5, the basal segment about as long as the two following together.

The place of this genus in the family is difficult to determine. According to the key of the tribes of DERMESTIDÆ given by Ganglbauer, it should fall into the MEGATOMINI\* as defined by him (*Käfer Mitteleur.* iv. part 1, 1904, pp. 8, 26), except for the curious form and disposition of the side-pieces of the metasternum—the large size of the meta-epimeron and the comparatively small size of the meta-episternum—and except for the minor discrepancy that the

\* Ganglbauer separates MEGATOMINI, the Central European genera of which are *Megatoma*, *Globicornis*, *Entomotrogus*, *Phradonoma*, *Trogoderma*, and *Ctesias*, from ATTAGENINI, the only Central European genus of which is *Attagenus*. Some writers, such as Reitter (*Fauna Germanica*, Käfer, iii. 1911, p. 151), include *Attagenus*, *Megatoma*, etc., all in one tribe, ATTAGENINI. Dalla Torre, in cataloguing the family (*Coleopt. Cat.* part 33, 1911), keeps the two groups separate, calling them ATTAGENINÆ and MEGATOMINÆ.

first segment of the middle and hind tarsi is shorter than, or at most as long as, the second, whereas Ganglbauer characterizes MEGATOMINI as having the first segment of those tarsi "longer than, or so long as, the second." If the genus be regarded as finding a place in the MEGATOMINI despite these points, it falls nearest to *Trogoderma* and *Phradonoma*, and the characters which distinguish it from these genera are indicated above. Thinking that the insect might have been described under one or other of these names, I have consulted descriptions of all species of those genera catalogued by Dalla Torre or indexed in the 'Zoological Record' since the date of his catalogue (1911) up to and including 1924. But no description corresponds with it, nor has any specimen identical with it been found among the DERMESTIDÆ of the British or Paris Museums.

Type of the genus : *Paratrogoderma mahense*, sp. n.

*Paratrogoderma mahense*, sp. n.

*Modice nitens, castaneum, antennis pedibusque fulvo-testaceis, antennarum clavâ obscuratâ: corpore pubescentiâ tenui, curtâ, decumbente, in superficie superâ aureo-brunneâ, in superficie inferâ pallidiorè, vestito; capite prothoraceque densissimo subtiliter punctulatis, hoc basi utrinque ad medium vago impresso; olytris dense subtiliter punctulatis et punctis majoribus inter punctis minutis sparsis, striâ suturali tenui ab apice fere ad scutellum extensâ.*

Long. corp. ca. 2 mm.

Body moderately shining, uniform chestnut-brown above and beneath; only the legs, feet, mouth-parts, and antennæ are lighter, tawny-testaceous, and the club of the antennæ is darkened. Surface clothed with a close, fine, short, decumbent pubescence, which is uniform golden-brown on the upper, paler on the lower, surface; there is a complete absence of erect hairs. *Head* and *prothorax* very closely and finely punctulate, the minute punctures being crowded (on the head especially) almost as closely as possible; *prothorax* with a vague depression at the base on either side of the median lobe; its anterior and posterior lateral angles deflexed, definite, the former wider than, the latter nearly equal to, a right angle. *Elytra* with two kinds of punctures; the surface is closely covered with minute points like those on the head and prothorax, and scattered among these are larger (but still small) shallow pits, two or more times their own diameter apart; the nature of the punctuation is only clearly discernible under a high power and on parts of the surface where the pubescence is rubbed

off; a fine sutural stria extends almost the entire length from the apex of the elytron to the apex of the scutellum, and bends gradually inwards closer to the actual suture at the front end; there is a vague and slight swelling in the humeral region, and the actual deflexed humeral angle, viewed in profile, is definite and wider than a right angle. *Metasternum*, *hind coxæ*, and *ventral abdominal segments* finely and closely punctate; the metasternum, in the male at any rate, has a very slight median depression.

*Loc.* Seychelles: Mahé, Silhouette. Mahé: Cascade Estate, 800–1000 feet, i. 1909, one example (the type); Cascade Estate, forest above 1000 feet, i. 1909, two ♂. Silhouette: Mare aux Cochons or forest immediately above, over 1000 feet, ix. 1908, one ♀.

### Lymexylonidæ.

This family is represented in the islands visited by the Expedition by a single species of *Melittomma*, *M. insulare*, which is a pest of coconut-palms, and is known from the Seychelles, the Amirantes, and Madagascar. Eleven species of this genus were catalogued by Schenkling in 1915 (Coleopt. Cat. part 64, p. 9), the ten others (excluding *M. insulare*) being recorded from various parts of tropical Africa and tropical South America, from Madagascar, Java, Sumatra, New Guinea, and China.

### MELITTOMMA, Murray.

*Melittomma insulare*, Fairmaire, Bull. Soc. Ent. France, 1893, p. cccxxiii; Alluaud, Liste Coléopt. de la Région Malgache, 1900, p. 156; Kolbe, Mitt. Zool. Mus. Berlin, v. 1910, p. 26.

*Loc.* Seychelles, Amirantes Islands, Madagascar.

Seychelles: Mahé, Silhouette. Mahé: previously obtained by Rev. Père Philibert, by Alluaud (1892), and by Brauer (1896); the Cambridge Museum possesses a ♀ obtained in that island in 1888 (*J. J. Lister*); there are several specimens collected by the Percy Sladen Trust Expedition, including a ♀ from Baie Lazare, 1908 (*Gardiner*), and adults, larvæ, and pupæ cut out of the base of a diseased coconut-palm at Barbarons Estate, 31. x. 1908, by R. P. Dupont, Mons. Michel (manager of the estate), and myself. Silhouette: Mare aux Cochons plateau and near by, over 1000 feet, ix. 1908, 4 ♂, 1 ♀.

Amirantes: Desroches Island, 1905 (*Gardiner*). Madagascar: see below.

There is great variation in size in the series of 9 ♂ and 7 ♀ before me, the length of the body ranging from just under 7 mm. to 16 mm. Curiously enough, both these extremes are ♀ specimens, the ♂ examples being intermediate in size, ranging from 8 to about 11.5 mm. These measurements in all cases are made from examples with the head deflexed.

This species, the early stages of which have apparently only been found in stems of the coconut-palm, was originally described from the Seychelles and seems to have been for many years only known from that archipelago. I believe that it is here recorded from the Amirantes for the first time. The record of the insect from Madagascar is cited from certain of the works to which reference is made below. In the Seychelles, so far as my experience goes, it only occurs in or near coconut-plantations, not in the unmixed endemic forest; even the Silhouette Mare aux Cochons, which is over 1000 feet above sea-level, and where several examples were taken, is only just at the upper limit of coconut-cultivation.

The larva has been figured by Gahan (Trans. Ent. Soc. London, 1908, p. 278, pl. vi. fig. 2) and also by Vuillet ('L'Agronomie Coloniale,' no. 2, 31st Aug., 1913, pp. 33-37, 1 pl.). The bionomics of the insect, the damage done by it, remedial measures, etc., are discussed in a number of economic entomological works, abstracts of which appear in the 'Review of Applied Entomology,' Series A, as follows:—i. 1913, p. 424; ii. 1914, p. 568; iv. 1916, p. 150; vi. 1918, pp. 68, 375-6; ix. 1921, p. 275; x. 1922, p. 576. The greater part of the information contained in these works is based on the observations of my old friend and helper, Mons. Rivalz P. Dupont, at present Director of Agriculture in the Seychelles.

### Rhipiceridæ.

This family is represented in the Seychelles by a single species of *Callirrhapis*, *C. philiberti*, Fairm., which was stated by Fairmaire to resemble closely *C. marmorea*, Fairm., from Cochin-China. *C. philiberti* is not known from any other part of the world but the Seychelles. 86 species of *Callirrhapis* are catalogued by Pic (Coleopt. Cat., Junk and Schenkling, part 81, 1925) from the Oriental, Indo-Malayan, and Papuan regions, from Madagascar, from Australia and certain of the South Pacific Islands, and from the Neotropical region (West Indies, Mexico, Central and South America);

but none at all from Africa. Some short notes on the local distribution, biology, rearing in confinement, and variation of *C. philiberti* are given below.

### CALLIRRHIPIS, Latreille.

#### *Callirrhapis philiberti*, Fairmaire.

*Callirrhapis philiberti*, Fairm., Bull. Soc. Ent. France, 1891, p. lxx; id., *op. cit.* 1893, p. ccxxiii; Alluaud, Liste Coléopt. de la Région Malgache, 1900, p. 204; Kolbe, Mitt. Zool. Mus. Berlin, v. 1910, p. 25.

*Loc.* Seychelles: Mahé, Silhouette, Praslin, La Digue, Long Island.

Previous to the Percy Sladen Trust Expedition this species had been recorded by Fairmaire from Mahé (*R. P. Philibert*) and La Digue (1892, *Alluaud*), and by Kolbe again from Mahé, where it was found by Brauer in all its stages, not uncommonly, on Mamelles Plantation. Some 12 ♂ and 19 ♀ were obtained by the Percy Sladen Trust Expedition, as well as larvæ and exuvæ of larvæ and of pupæ. The data in detail are as follows:—Mahé: Baie Lazare, 1908 (*Gardiner*); Cascade Estate, between 800 and 2000 feet, various dates between x.1908 and ii.1909; jungle between Trois Frères and Morne Seychellois, 1500–2000 feet, xii.1908; and several other examples from places not exactly recorded, 1905 and 1908–9. Long Island: vii.1908, 1 ♀, bred (possibly from a decayed coconut-palm stem, as not many other kinds of trees grew on this small islet). Praslin: xi.1908, 2 ♂; the Cambridge Museum also possesses a small ♂ labelled “Pasquière, Praslin, Feb. 21, 1888 (*J. J. Lister*).” Silhouette: high forests near Mont Pot-à-eau, about 1500 feet, viii.1908, and above Mare aux Cochons, over 1000 feet, ix.1908, 2 ♂, 12 ♀, all bred from pupæ, or in some cases from larvæ, found in decaying wood; one ♂ and one ♀ are recorded to have been bred from pupæ found in “Bois Rouge” (*Wormia ferruginea*), and one ♀ from a larva found in the decayed stem of an endemic palm (probably *Verschaffeltia*); in the other cases the names of the trees, etc., are not recorded.

It is thus evident that this species occurs not only in the endemic forests in the mountains, but also in cultivated places near sea-level, and that the curious, hard, shining, cylindrical larvæ feed not only in decaying hard wood like that of the “Bois Rouge” (which they reduce to a soft moist frass), but also in stems of palms. Many specimens were easily bred in glass vessels with metal screw-tops, after

the method which I had learnt from Dr. David Sharp, and which he employed chiefly for rearing certain British Longicorns. Wide-mouthed bottles,  $2\frac{1}{2}$  inches high and  $\frac{7}{8}$  inch in diameter (outside), or sometimes slightly larger sizes, were used. A single larva or pupa was placed in each bottle, the latter being fairly tightly packed with fragments of the wood, leaving only a few crevices just big enough to receive the larva or pupa, so that the creature could not be injured by being shaken about. The top of the bottle was then tightly screwed up, and the bottle left undisturbed for a considerable period, either until it could be seen through the glass that the transformation was completed or until it seemed to be time to turn the contents out carefully and investigate how matters stood. I regret that I could not, in my busy eight months in the islands, keep fuller records of these rearings and of the kind of wood in which the larvæ or pupæ were found in each case. Certain of the endemic CERAMBYCIDÆ were reared in the same way.

It is noteworthy that the specimens bred from larvæ or pupæ found in Silhouette during the drier months (August and September) are nearly all ♀, the numbers being, as stated above, 2 ♂ and 12 ♀; whilst 5 ♂ and 4 ♀ were either reared or found in the adult state in Mahé in the hotter and wetter months from October to February (inclusive).

In this series the length of the body varies in the ♂ from 16 mm. to 21 mm., and in the ♀ from 20 mm. to 26 mm.

### Sphindidæ.

This small family is represented in the Seychelles by two very distinct species of *Aspidiphorus*. One of them appears to be a form of a European species, the second is described as new. As far as I can judge from my field-notes, the majority of the specimens were taken in the endemic mountain-forests, but one at least was found outside their limits. It is hard to imagine how these small dwellers in fungi could have been artificially imported, and I think it probable that they form part of the endemic fauna.

There is no recent catalogue of SPHINDIDÆ, but the genus *Aspidiphorus* is known from Europe, Transcaucasia, Japan, the Kumaon Himalayas and Sikkim, Christmas Island (Indian Ocean), Java, Borneo, Queensland, and Tasmania (Christmas Island, Java, Borneo, and Tasmania are included on the strength of information kindly sent me by Mr. G. J. Arrow as to the presence in the British Museum of unnamed



examples from these localities). It does not appear to occur in North America (see the late Col. Casey's account of the SPHINDIDÆ of North America, Journ. N.Y. Ent. Soc. vi. 1898, pp. 92, 93), nor is it known from South America; while neither this genus nor any other representatives of the SPHINDIDÆ are recorded from the Hawaiian Islands or any of the Atlantic Islands (Madeira, Canaries, Cape Verde Is., and Saint Helena). Reitter in 1902 (Wien. Ent. Zeit. xxi. p. 139) gave a table of the four species then known to him—namely, the European *A. orbiculatus* and *A. lareynii*, the Transcaucasian *A. confusus*, and, lastly, *A. japonicus*. Champion in 1924 (Ann. & Mag. Nat. Hist. (9) xiii. p. 263) added a note on the distribution of the genus to his description of *A. asiaticus*, from the Kumaon Himalayas.

#### ASPIDIPHORUS, Latr.

*Aspidiphorus lareynii* \*, Duval, var. ?

*Aspidiphorus lareynii*, Duval, Glan. Ent. i. 1859, p. 39.

There is a series of examples from the Seychelles, the identity of which with *A. lareynii* was suggested to me by Mr. G. C. Champion, who kindly lent me a specimen of that species from Herzegovina. With careful examination I can see no difference in either the upper or lower surface of the body between the Seychelles specimens and the European example, but there is a distinct structural difference in the form of their antennæ. These organs have not been detached and mounted in balsam, but have been examined under the highest powers of the microscope applicable to the carded insects—namely, magnifications varying between 90 and about 170 diameters. The 4th segment of the antenna in the European example is short, not longer than broad, about  $\frac{1}{3}$  the length of the third segment; while in the Seychelles examples the fourth segment is distinctly longer than broad, and appears nearly half as long as the third. The length of the Seychelles examples is about 1.7 mm. Without examining more European material, I prefer not to name the Seychelles form as a distinct species or subspecies, though probably it should have some such status.

*Loc.* Seychelles: Silhouette, Mahé. Silhouette: near Mont Pot-à-eau, viii. 1908, 1 example. Mahé: from fungus near Trois Frères, about 1000 feet, xii. 1908; Cascade Estate, about 8000 to 1000 feet, various dates between x. 1908 and

\* Mr. Arrow informs me that this is the original spelling of the specific name. The Munich Catalogue gave *lareynei*, and later writers have used the form *lareyniei*.

iii. 1909; Mare aux Cochons district, 1000–2000 feet, i.–ii. 1909; the Mahé specimens are 15 in all. Evidently an inhabitant of the endemic forests.

The typical form of *A. lareynii* is widely spread in Europe, but does not occur in Britain.

*Aspidiphorus perexiguus*, sp. n.

Minutus, obovatus, nitidus, capillis tenuibus, brevibus, pallidis, erectis vestitus; piceo-brunneus, antennis pedibusque flavo-brunneis, antennarum clavis opace nigris; capite sine lineis frontalibus, subtilissime punctulato, utrinque ad basin punctis magnis nonnullis; prothorace antrorsum angustato, lateribus (magis antice) explanatis, basi in medio productâ, ante scutellum truncatâ, utrinque sinuatâ, superficie subtilissime punctulatâ, punctis magnis irregulariter sparsis, ad basin et ad latera magis numerosis; scutello latiore quam longiore, scutiformi, angulis rotundatis; elytrorum punctis seriatis magnis, intervallis lævis, subtilissime haud dense punctulatis; prosterno inter coxas laminam triangularem, apice antrorsum, formante; metasterno antice, ad latera, et ad marginem posteriorem fortiter punctato, medio (lineâ mediâ longitudinali exceptâ) impunctato.

Long. corp. fere 1.1 mm.

Obovate, attaining its greatest breadth at about  $\frac{3}{4}$  of the length of the elytra from the base; shining, dark pitchy-brownish, the mouth-parts a little lighter, antennæ and legs yellowish-brown, the clubs of the antennæ dull black; body clothed with short, fine, erect, pale hairs. *Head* without frontal striæ (cf. *A. orbiculatus*), its surface bearing excessively fine punctures and a group of about 3–6 large strong punctures on either side near the base. *Antennæ* with segment 3 long and slender, considerably longer than 2, 4 also long and slender, quite half as long as 3 (if not more), and about as long as 5 and 6 together, 5–7 being all very short (these approximate measurements are made by viewing the antenna still attached to the insect under a magnification of 100 diameters or more, but not from a balsam-preparation). *Prothorax* short, narrowing from base to front (more strongly than in *A. orbiculatus*), front margin straight, side-margins slightly arcuate and explanate, the flattening becoming wider towards the front angles; in side-view the front angles are nearly right angles and the hind angles are greater than a right angle; viewed from above the front angles are obtuse, and there is a constriction of the outline of the body at the base of the prothorax; the base is not margined, it is produced backwards and truncate in front of

the scutellum, and slightly sinuate on either side of this; the surface bears exceedingly fine punctures and irregularly scattered large punctures, more numerous towards the base and sides. *Scutellum* broader than long, broadly shield-shaped with the angles rounded off, its surface bearing exceedingly fine punctures. *Elytra* with the seriate punctures circular and large (larger, in proportion to the size of the insect, than in *A. orbiculatus*), those in each series about their own diameter apart; the first series lies extremely close to the sutural margin; the three innermost series bend outwards at the base, while the next three series pursue a slightly sinuous course towards the base, bending first outwards and then inwards at the extreme base; the intervals are smooth and flat, and the exceedingly fine punctures on them are several times their own diameter apart and only visible under a high power; the hairs arise both from these fine intervallar punctules and from the large seriate punctures (on the head and prothorax also the hairs arise from the large as well as from the fine punctures); the humeral callus is well marked. *Prosternum*: the elevated part between the coxæ forms an isosceles triangle, the apex pointing forwards (cf. *A. orbiculatus*, in which the triangle is truncate in front, forming a quadrangular plate); its margin is elevated and its surface rugosely punctate. *Mesosternum* forming a transverse plate, with front margin elevated, straight in the middle but curved backwards at either side, and with surface devoid of large punctures. *Metasternum* strongly convex in the middle, which part is smooth and impunctate except for a single longitudinal line of large punctures along the middle line; there is also a transverse series, lying in a depression along the hind margin and practically continuous from side to side; there are on either side two series of large punctures extending from the front margin and curving round behind the middle coxa, and the lateral parts in front of these series are closely and coarsely punctate, as are also the episterna. First *ventral abdominal segment* rather closely covered with large strong punctures, a series of which also extends across the base of each of the following sternites.

*Loc.* Seychelles: Silhouette, Mahé, Praslin. Silhouette: from cultivated country near the coast, ix. 1908, 1 specimen. Mahé; Cascade Estate, between 800 and 1500 feet, i.-ii. 1909, 1 example. Praslin: Côtes d'Or Estate (probably from the forest of Coco-de-Mer (*Lodoicea*) palms in the Vallée de Mai), xi. 1908, 2 specimens.

This minute species is well characterized by its small size, the form of the antennal segments, the absence of frontal

striae, the nature of the punctuation of its head and prothorax, the shape of the prothorax, scutellum, and prosternum, and the arrangement of the punctuation of its metasternum. It appears to be quite distinct from its congeners and, like so many Seychelles representatives of genera of minute insects known from other parts of the world, to be even more minute than the other members of its genus.

#### Throscidæ.

No member of this family has previously been recorded from any of the islands visited by the Percy Sladen Trust Expedition, and its inclusion is based on a single specimen from the Seychelles of the genus *Aulonothroscus*. There is no very recent catalogue of THROSCIDÆ, but the following summary of the distribution of *Aulonothroscus* has been compiled from the 'Zoological Record.' The genus was erected in 1890 to contain two species from Guatemala; in 1895 three species were described from Brazil, one from Mexico, and five from Sumatra; in 1896, two species from New Guinea and one from Burma; in 1911, one was described from the French Antilles, and in 1916 one from Argentina; in 1918 seven species were described from the United States; in 1919, three from East Africa; while in 1922 one was described from Texas. The genus therefore has a very wide distribution in the warmer parts of the Old and New Worlds.

AULONOTHROSCUS, G. Horn, Biol. Centr.-Amer., Col.  
iii. 1, p. 208, 1890.

#### *Aulonothroscus* sp.

One example, in poor condition, determined in 1922 by Mons. E. Fleutiaux as near *A. trixagoides*, Fleutiaux, a species which was described from East Africa ("Voyage Alluaud et Jeannel en Afrique Orientale," Ins. Coléopt. xiii. p. 109, 1919).

*Loc.* Seychelles. Praslin: Côtes d'Or Estate, probably from the forest of Coco-de-Mer (*Lodoicea*) in the Vallée de Mai, xi. 1908.

#### Brenthidæ.

#### EUPSALIS, Lacordaire.

*Eupsalis amitina*, Kolbe, Mitt. Zool. Mus. Berlin, v. 1910, p. 39.

This species was described from a single ♂ collected by Brauer. A single ♀ was taken by the Percy Sladen Trust Expedition, and was determined by Dr. R. Kleine in 1921.

The original ♂ was 13·5 mm. long; this ♀ is about 9 mm. long (the rostrum in both cases being included). The ♀ has the rostrum narrow and cylindrical, slightly narrowed at the base, where it is compressed on either side; immediately behind the bases of the antennæ the head is transversely elevated, and behind this elevation there is a rather deep, slightly elongate, median depression. Antennæ inserted at the base of the rostrum, rather less than twice the length of the rostrum, of eleven segments, the basal segment rather long, stout, and curved, segment 2 about as long as 3 on its outer side, about  $\frac{2}{3}$  as long as 3 on its inner side, 4 very slightly shorter than 3, 5 slightly longer than 3, 6 slightly shorter, 7 and 8 slightly longer and subequal, 9 and 10 considerably longer, about  $1\frac{1}{2}$  times the length of 7 and 8, 11 the longest of all, about  $1\frac{1}{2}$  times as long as 10. The basal yellow marks on the elytra are not entirely broken up each into three parts, as would appear (from Kolbe's description) to be the case in the ♂, but each forms a single mark, extending over intervals 3-5 and produced backwards along interval 4, but the mark is broken into and made irregular in front by the dark colour of the foveiform punctures at the base of two of the series; the inner two of the three small post-basal marks on each elytron also are virtually united in front. In other respects Kolbe's description of the ♂ is applicable also to the ♀.

*Loc.* Seychelles: Mahé, Silhouette. Mahé: 1 ♂ (*Brauer*). Silhouette: from the plateau of Mare aux Cochons or the forest above, over 1000 feet, ix. 1908, 1 ♀.

Kolbe compares this species rather closely with two species from Madagascar, but evidently regards it as quite distinct and as being also clearly separated from certain East African species.

No other Brentid is known from any of the islands visited by the Expedition.

#### VIII.—" *Spolia Mentawia* ": *Reptiles and Amphibians.*

By MALCOLM A. SMITH, M.R.C.S., L.R.C.P., F.Z.S.

INTRODUCTION. By C. BODEN KLOSS, F.Z.S.

This paper deals with a collection made in September-November 1924, when, accompanied by Mr. N. Smedley, Assistant Curator of Raffles Museum, Singapore, and a

party of native collectors, I visited the islands of Siberut and Sipora, which lie about 70 to 80 miles off the west coast of Sumatra south of lat.  $1^{\circ}$  south. Siberut is about seventy miles long and thirty broad, Sipora is about a quarter of its area. The islands are densely forested except where clearings have been made, the lowlands are very swampy, and there are no hills rising above 1500 feet.

The material came from the shores, villages, cultivated patches and forests of the lowlands, and from such hills as we were able to reach from our collecting stations at Siberut on the island of that name and from Sioban on Sipora.

Modigliani had already collected in Sipora during the 'eighties, and a few things had been secured later by Maas; the zoology of Siberut was known only from a small set of reptiles obtained by a member of the military station at the instigation of Herr Edward Jacobson. Dr. W. L. Abbott and myself had collected on the Pagi Islands in 1902, but the results have not been put on record; there is no reason to believe, however, that their reptiles and amphibians differ from those of the other islands. Thus we have a fair idea of the herpetology of the group, save that the names of North and South Pagi Islands do not appear among the localities for species.

The above islands, which form the very homogeneous Mentawi Group, are almost certainly connected with each other by a ridge or bank less than 100 fathoms in depth, but the group is surrounded by much deeper water than this (it lies, in fact, near the 500-fathom contour-line), and, further, everywhere directly between it and Sumatra lies the Mentawi Basin with depths of 500 to 1000 fathoms. Thus its conditions are very different from those of practically the whole of Malaysia (*i. e.*, the Peninsula, Sumatra, Java, Bali, Borneo, Palawan), which stands on the shallow Sunda Shelf with depths of 40 fathoms or less, and it is disappointing to find that, though the occurrence of several of the species is interesting, there appear in the fauna none of those peculiarities which are so common amongst the mammals, birds, and other classes.

As reports on the large collections secured are prepared they will be published in various journals under the general title "*Spolia Mentawia*."

A series of specimens from this collection has been presented to the British Museum of Natural History.

## LIST OF THE SPECIES OBTAINED.

The following species have not been recorded before from one or other of the islands :—

## LIZARDS.

- Draco formosus*, Bouleng. Siberut.  
 — *fimbriatus*, Kuhl. Siberut.  
*Varanus salvator* (Laur.). Sipora.  
*Gekko monarchus* (D. & B.). Siberut, Sipora.  
*Emoia atrocostatum* (Lesson). Siberut.

## SNAKES.

- Xenopeltis unicolor*, Reinw. Siberut.  
*Sibynophis geminatus* (Boie). Siberut.  
*Dendrophis formosus* Boie. Siberut, Sipora.  
*Maticora bivirgata* (Laur.). Siberut.  
*Trimeresurus granineus* (Shaw). Siberut, Sipora.  
*T. puniceus* (Boie). Siberut.

## AMPHIBIANS.

- Rana kuhli*, Schlegel. Siberut.  
 — *macrodon*, Kuhl. Siberut.  
*Polypedates leucomystax* (Kuhl). Siberut.  
*Philautus pictus* (Peters). Siberut.

The following species must be discussed in greater detail :—

*Mabuia rugifera* (Stol.).

- Tiliqua rugifera*, Stoliczka, Jul. Asiat. S. Bengal, 1870, xxxix. p. 170, pl. x.  
*Mabuia rugifera*, Bouleng. Cat. Liz. B.M. 1887, iii. p. 184; id. Zool. Rec. 1896, p. 22; De Rooij, Rept. Indo-Austr. Archipel. 1915, i. p. 160.  
*Mabuia quinquecarinata*, Werner, Verh. Ges. Wien, 1896, p. 12; id. Zool. Jahrb. Syst. 1900, xiii. p. 487; De Rooij, Rept. Indo-Austr. Archipel. 1915, i. p. 159.

Siberut, 25 specimens.

In 1896, in a note in the 'Zoological Record,' Boulenger united *quinquecarinata* with *rugifera*. This was opposed by Werner in 1900 (Zool. Jahrb.) and upheld by De Rooij in 1915 (Rept. Indo-Austr. Archipelago), who gave the following characters by which to distinguish the two :—

*quinquecarinata*.

Parietals in suture.  
 A postnasal.  
 28 scale-rows.

*rugifera*.

Parietals separated.  
 No postnasal.  
 26 scale-rows.

I have not examined the type of *rugifera*, but Stoliczka's figure very clearly shows that the parietals are in suture, the interparietal being very small. In the series before me, including those in the British Museum, the interparietal is prolonged backwards and separates the parietals in seven.

The postnasal is variable, and whether it should be considered present or absent depends upon how clearly the posterior rim of the nostril is defined. In Mr. Kloss's series 26 scale-rows on the body occur in seven examples, 28 scale-rows in the remainder. About half of them have the back uniformly brown, the others have five or seven whitish longitudinal lines.

*Dasia olivacea*, Gray.

One example from Siberut. Its markings are unusual. The ground-colour of the back is of a very dark brown with a more or less conspicuous white mark down the centre of each scale, the result being the formation of a series of white longitudinal lines extending from the nape to the root of the tail. The dorsal scales are feebly keeled.

*Boiga nigriceps brevicauda*, subsp. n.

Five examples. Siberut, Sipora.

Differs from the typical form only in having fewer subcaudal shields.

*Boiga nigriceps* has been recorded from the Malay Peninsula, Borneo, Java, Sumatra, Simalur, Nias, and Siberut, the subcaudal count ranging from 134 to 154. Of the record from Siberut I have no details, but a specimen recently examined by Dr. Roux from the adjacent island of Nias has 135 subcaudal shields. The variation for the five examples mentioned above is 114 to 124.

*Colour.* Pale greyish brown above with indistinct darker markings or bands; in the three youngest there is in addition a series of black dorsal spots.

*Details of the Specimens.*

No.	Sex.	Scales.	Vent.	Caud.	Locality.
8972	♀	21. 21. 15	252	114	Siberut.
8973	♀	" " "	255	?	Sipora.
8987	♀	" " "	249	117	Siberut. Type.
8988	yg.	" " "	256	124	"
8989	♂	" " "	249	122	Sipora.

*Culamaria klossi*, sp. n.

Type adult female, author's number 8984, collected on Siberut in Sept. 1924.



*Description.* Diameter of the eye equal to its distance from the mouth; rostral broader than high, visible from above; frontal as broad as long, twice as broad as the supraoculars, shorter than the parietals; one large præ- and two postoculars; six supralabials, the third and fourth touching the eye, the last very long; first pair of infra-labials in contact with one another behind the symphysial; two pairs of well-developed sublinguals in contact with each other.

Scales in 13 rows; ventrals 259; anal undivided; sub-caudals 16.

*Colour.* Rich brown above with five black longitudinal lines, the vertebral one occupying two and a half to three scale-rows, the central portion of which may be brown-spotted, the second one on scale-rows 2 and 3, the third occupying the middle of scale-row 1, which is otherwise white; below white with broad, black, transverse bars; head above brownish; tail above with two black spots.

Total length 350 mm.; tail 20 mm.

*Rana chalconota*, Schlegel.

Very common on Siberut. Van Kampen has separated *R. chalconota* from *R. labialis* on the comparative size of the disc of the second finger as compared with that of the third and fourth (Amphib. Indo-Austr. Archipel. 1921, p. 218). After examining Mr. Kloss's material and also that in the British Museum of Natural History, I find myself unable to distinguish two species on the characters given by him.

*Philautus horridus*, Boulenger.

*Ixalus horridus*, Boulenger, Fascic. Malay. Zool. 1903, i. p. 139, pl. vi.; Rept. Malay Penin. 1912, p. 256.

One half-grown example from Siberut. The specimen agrees well with the types, two adults and one juvenile, from Patani, except for slight differences. The snout is a little more rounded in my specimen, the tympanum about three-quarters the diameter of the eye, and the upper parts except on the head much less warty, in which respect it agrees with the type juvenile. Colour greyish black above, paler over the shoulders and loins; below jet-black vermiculated with white. The species has not been recorded before from the Archipelago.

*Kaloula boulengeri*, nom. nov.

*Phrynella pulchra*, Boulenger, Fauna Malay Penin., Rept. & Batr. 1912, p. 265.

Siberut. Three specimens.

The genus *Phrynella* has been distinguished from *Kaloula* by having no ridges across the palate; in other respects the two agree. An examination of the types and other specimens in the British Museum, however, together with Mr. Kloss's material, shows that there is a distinct ridge on the palatine bones behind the choanæ and two denticulated ridges in front of the œsophagus, the anterior one sometimes only feebly distinct, the posterior always quite distinct. The tongue is oblong and entire; the pupil probably circular in life, but in spirit specimens may be contracted slightly in a vertical or horizontal direction.

*Phrynella* therefore has the same generic characters as *Kaloula*, and the name should become a synonym of *Kaloula*. Its two species, *P. pulchra* and *P. pollicaris*, agree with each other and differ from the other members of the genus *Kaloula* in the unusual development of the metacarpal tubercles.

It is unfortunate that Mr. Boulenger's name *pulchra* cannot be maintained, as it is already occupied for the common and widely distributed *Kaloula pulchra* of Gray. It is with much pleasure in renaming the species that I associate it with the name of the great herpetologist. The types of *Phrynella pulchra* become the types of *Kaloula boulengeri*.

IX.—*Otoliths of Fishes from the Jurassic of Buckinghamshire and Dorset.* By G. ALLAN FROST, F.L.S., F.G.S., F.Z.S.

[Plate IV.]

THE specimens here described were obtained from the Upper Kimmeridgian of Hartwell, Buckinghamshire, and from the Lower Lias of Charmouth, Dorset.

For this material I am indebted to Mr. T. H. Withers, F.G.S., of the Geological Department of the British Museum. The Kimmeridgian specimens were washed by Mr. Withers from material collected by Mr. E. Hollis, F.Z.S., of the

Aylesbury Museum, and Mr. C. P. Chatwin, F.G.S., and the Liassic specimens were obtained in the same way from clay collected by Mr. L. R. Cox, F.G.S.

With the exception of two specimens referred to the family Leptolepidæ, it is not possible to determine more closely the relationships of the specimens. Among recent fishes we have the otoliths in connection with the skulls, but this is not the case with fossils, and these otoliths are always found separately—it is therefore only by a destructive examination of the contemporary fossil fishes that one may hope eventually to be able to establish their identity.

*Otolithus (Leptolepidarum) rostratus*, sp. n.

(Pl. IV. figs. 1, 2, 3.)

*Diagnosis.* Dimensions  $5 \times 2\frac{1}{2}$  mm.

Sagitta, shape wedge-like, straight, outer side striated, inner side longitudinally ridged, dorsal rim high posteriorly, descending anteriorly to point of rostrum, ventral rim curved, posterior rim oblique; anterior part of otolith consists of a broad rostrum; no antirostrum or excisura. Sulcus broad, opens on anterior half of dorsal rim, ostium large, occupies dorsal half of rostrum, cauda with angle, straight anteriorly, obliquely inclined posteriorly, terminates on posterior rim of otolith, slight angle on lower line between ostium and cauda. Lower edge of sulcus forms longitudinal ridge across otolith.

*Material.* Two examples including holotype (Pl. IV. fig. 1).

*Distribution.* Upper Jurassic, Upper Kimmeridgian ("pallasianus" zone), Hartwell, Buckinghamshire, and Swindon, Wilts.

*Remarks.* This species resembles the otoliths of the Elopidae in general appearance, but differs in its straightness and in the greater breadth and length of the sulcus. The ridge of the lower edge of the sulcus resembles that of *O. (Leptolepidarum) cuneiformis*, Frost\*.

*Otolithus (Leptolepidarum) gracilis*, sp. n. (Pl. IV. fig. 4.)

*Diagnosis.* Dimensions  $3 \times 1\frac{1}{2}$  mm.

Sagitta, shape wedge-like, outer side straight, flat, inner side ridged, dorsal rim oblique anteriorly, curved posteriorly, forming angle with ventral rim, which is curved. Rostrum,

\* Ann. & Mag. Nat. Hist. ser. 9, vol. xiv. p. 141 (1924).

no antirostrum or excisura. Sulcus narrow, curved, cauda raised, descending to termination on posterior rim.

*Material.* Two examples, including the holotype (Pl. IV. fig. 4).

*Distribution.* Upper Jurassic, Upper Kimmeridgian ("pallasianus" zone), Hartwell, Buckinghamshire.

*Remarks.* This form is peculiar among the Elopine Jurassic otoliths so far described, owing to the narrowness of the cauda and the sigmoidal curve of the sulcus. The shape is less primitive than in other contemporaneous forms, and approaches nearer those of the otoliths of recent Neopterygian fishes.

*Otolithus* (incertæ sedis) *elegans*, sp. n. (Pl. IV. figs. 5, 6.)

*Diagnosis.* Dimensions  $1\frac{1}{2} \times 1$  mm.

Lapillus, shape conchoidal, inner side (Pl. IV. fig. 5) convex, with central umbo, edges serrated, outer side (Pl. IV. fig. 6) convex, with irregular sulcal area on anterior part, dorsal rim domed, ventral rim curved, posterior rim small, rounded; lower part of anterior rim consists of a broad rostrum, upper part is vertical.

*Material.* The unique holotype (Pl. IV. figs. 5, 6).

*Distribution.* Upper Jurassic, Upper Kimmeridgian ("pallasianus" zone), Hartwell, Buckinghamshire.

*Remarks.* A utricular otolith resembling those of the Siluroids, in which the lapillus is the principal otolith.

*Otolithus* (incertæ sedis) *hartwellensis*, sp. n.  
(Pl. IV. fig. 7.)

*Diagnosis.* Dimensions  $1\frac{1}{2} \times 1$  mm.

Lapillus, shape trifoliate, biconvex, dorsal rim small, rounded, ventral rim irregular, lateral rims rounded.

*Material.* The unique holotype (Pl. IV. fig. 7).

*Distribution.* Upper Jurassic, Upper Kimmeridgian ("pallasianus" zone), Hartwell, Buckinghamshire.

*Remarks.* Resembles in contour the lapilli of recent Neopterygian fishes, in which the lapillus is not the principal otolith.

*Otolithus* (incertæ sedis) *depressus*, sp. n. (Pl. IV. fig. 8.)

*Diagnosis.* Dimensions  $2 \times 1$  mm.

Lapillus, shape ovate, biconvex, median depression of one

side below dorsal rim ; dorsal rim concave, ventral rim curved, posterior rim pointed, anterior rim rounded. No sulcus.

*Material.* Fifteen examples, including holotype (Pl. IV. fig. 8).

*Distribution.* Upper Jurassic, Upper Kimmeridgian ("pallasianus" zone), Hartwell, Buckinghamshire.

*Remarks.* The shape resembles that of the lapillus in the recent Cyprinid *Barilius*, and, although there can be no relationship, the resemblance marks the example described as a utricular otolith. In some of the specimens obtained the dorsal rim is straight, with the posterior point on a level with it.

*Otolithus* (incertæ sedis) *rotundus*, sp. n. (Pl. IV. fig. 9.)

*Diagnosis.* Dimensions  $1 \times 1$  mm.

Lapillus, shape roughly circular, strongly biconvex, no sulcus.

*Material.* The unique holotype (Pl. IV. fig. 9).

*Distribution.* Upper Jurassic, Upper Kimmeridgian ("pallasianus" zone), Hartwell, Buckinghamshire.

*Remarks.* A minute lapillus resembling those of recent Teleostean fishes.

*Otolithus* (incertæ sedis) *withersi*, sp. n.

(Pl. IV. figs. 10, 11, 12.)

*Diagnosis.* Dimensions  $2\frac{1}{4} \times 2$  mm.

Sagitta, shape triangular, outer side (fig. 10) flat, furrowed, inner side (fig. 11) flat, smooth ; dorsal rim pointed, ventral rim curved, posterior curved, anterior rim oblique. Sulcus wide, divided by angle of upper margin, opens widely on anterior rim, cauda shorter than ostium, does not reach posterior rim.

*Material.* Eleven specimens, including holotype (Pl. IV. figs. 10, 11).

*Distribution.* Lower Jurassic, Lower Lias (top of "iber" zone), bed 120, and ("ruricostatus" zone) bed 99 of W. D. Long\*, E. of Charmouth, Dorset.

*Remarks.* The height of these otoliths suggests that they may be derived from deep-bodied Ganoids, such as *Dapedius* or *Lepidotus*. I have named this species after Mr. T. H. Withers, F.G.S., to whom I am indebted not only for the material now described, but for further material, all obtained by washing down clays in search of small fossils.

\* Proc. Geol. Assoc. xxv. pt. 5 (1914).

*Otolithus* (incertæ sedis) *oblongus*, sp. n. (Pl. IV. fig. 13.)

*Diagnosis.* Dimensions  $3 \times 1$  mm.

Sagitta, shape ovate, both sides flat, dorsal rim curved and highest anteriorly, ventral rim straight, posterior rim oblique, anterior rim pointed, short blunt rostrum, no antirostrum or excisura; sulcus not discernible.

*Material.* Three specimens, including holotype (Pl. IV: fig. 13).

*Distribution.* Lower Jurassic, Lower Lias (top of "ibex" zone), bed 120 of W. D. Lang, E. of Charmouth, Dorset.

*Otolithus* (incertæ sedis) *curvatus*, sp. n. (Pl. IV. fig. 14.)

*Diagnosis.* Dimensions  $2\frac{1}{4} \times 1$  mm.

Sagitta, shape irregular, curved in its length, outer side concave, inner side convex; dorsal rim concave, rounded posteriorly passing into posterior rim, ventral rim curved, forms angle with posterior rim, posterior rim curved; anterior of otolith narrow rounded, with lateral sigmoidal curve. Sulcus not discernible.

*Material.* Five specimens, including holotype (Pl. IV. fig. 14).

*Distribution.* Lower Jurassic, Lower Lias (top of "ibex" zone), bed 90, and ("raricostatus" zone), bed 120 of W. D. Lang, E. of Charmouth, Dorset.

*Remarks.* The shape is indicative of an elongated fish, which may have belonged to the families of Macrosemiidae or Eugnathidae.

#### EXPLANATION OF PLATE IV.

$\times 10$ .

- |          |  |                       |
|----------|--|-----------------------|
| Fig. 1.  | <i>Otolithus</i> ( <i>Leptolepidarum</i> ) <i>rostratus</i> , sp. n. | Sagitta, inner side.  |
| Fig. 2.  | " " " " "  | outer side.           |
| Fig. 3.  | " " " " "  | inner side.           |
| Fig. 4.  | " " <i>gracilis</i> , sp. n.   | Sagitta.              |
| Fig. 5.  | " (incertæ sedis) <i>elegans</i> , sp. n.                            | Lapillus, inner side. |
| Fig. 6.  |  | outer side.           |
| Fig. 7.  | <i>hartirellensis</i> , sp. n.                                       | Lapillus.             |
| Fig. 8.  | <i>depressus</i> , sp. n.  | "                     |
| Fig. 9.  | <i>rotundus</i> , sp. n.   | "                     |
| Fig. 10. | <i>withersi</i> , sp. n.   | Sagitta, outer side.  |
| Fig. 11. | " " " "  | inner side.           |
| Fig. 12. |  |                       |
| Fig. 13. | <i>oblongus</i> , sp. n.   | Sagitta.              |
| Fig. 14. | <i>curvatus</i> , sp. n.   | "                     |

X.—*A Description of Two Scottish Enchytræidæ (Oligochæta)*. By J. STEPHENSON, M.B., D.Sc., Lecturer in Zoology, Edinburgh University.

AMONG some Oligochæta recently sent me for identification by Mr. W. Harper, of the Department of Zoology, University College, Dundee, are two species of Enchytræidæ, one of which is apparently new; while the other, though probably identical with a form already known, seems sufficiently interesting to merit a short description.

Unfortunately, both species are represented by only a single specimen in spirit; and students of the family will recognize the difficulty of such an investigation. Not much accurate knowledge is to be gained by examination of the whole worms, owing to their comparative opacity; and for anything like a complete account recourse must be had to sections. In a single series of sections, however, the process of reconstruction is often difficult; and such a series is liable to mislead, owing to the absence of any possibility of comparison in the cases of obscure or ambiguous appearances.

Genus *MESENCHYTRÆUS*, Eisen.

*Mesenchytræus harperi*, sp. n.

Seaton Wood, Arbroath; under the surface of an old path. A single specimen, sexually mature.

*External Features.*

Length about 20 mm.; maximum diameter about 0·8 mm. Colour light grey. Segments 55.

Prostomium short, bluntly triangular, rather broader at the base than long.

Head-pore close to (just dorsal to) the tip of the prostomium.

Setæ with the Lumbricilline curve; the ventral setæ usually six or seven per bundle in front of the clitellum, five to seven (seven most commonly) behind; the lateral setæ usually five (four to six) in front, usually six (five to seven) behind the clitellum.

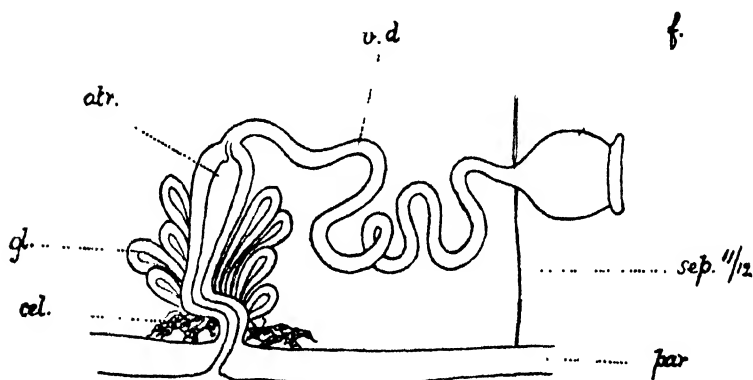
The clitellum is very thick and well marked, extending forwards halfway through segment xi., while behind it just gets on to segment xiv.

*Internal Anatomy.*

The cœlomic corpuscles are not very numerous; they are irregular in shape, nucleated, and of spongy appearance; they seem to have aggregated together into amorphous coagulum-like masses.

There are seven pairs of septal glands, in segments iv.-x.; those in segments vii.-x. (which may be called supernumerary, since they are in excess of the usual three pairs in segments iv.-vi.) are situated ventrally in their respective segments, and not attached to the septa.

The dorsal vessel begins in segment xiii.; it contains, as usual in the genus, a cardiac body.



*Mesenchytræus harperi*; male efferent apparatus, diagrammatic, reconstructed from sections.

*atr.*, atrium; *cel.*, loose cellular tissue round base of atrium; *f.*, funnel; *gl.*, glands round atrium; *par.*, parietes; *sep. 11, 12*, septum between segments xi. and xii.; *v.d.*, vas deferens.

The anteseptal portion of the nephridia is narrow and cylindrical, though of relatively considerable length. The organs have the characters of those of the genus; the duct, a continuation of the postseptal portion, is cylindrical and equal in length to the postseptal; it opens just behind the intersegmental furrow.

Sperm-morulæ are scattered in segment xi.; the testes have disappeared. There are no sperm-sacs; a few loose morulæ have escaped, and are found here and there in the anterior segments.



The male funnels are small and subpherical in shape, being almost as broad as long (*cf.* text-figure). The vas deferens is considerably twisted, and if straightened out would probably occupy about twice the length of the direct interval between the hinder end of the funnel and the ental end of the atrium; this would give it a length of about six times that of the funnel.

The atrium is somewhat club-shaped; it stands less than half the height of the segment, and its slightly thinner ectal portion is rather twisted or bent before it enters the body-wall. The vas deferens joins it at its upper end.

Around the atrium are a number—about ten or twelve, or possibly more—of elongated club-shaped glands, with a rather indefinite lumen. These glands are composed of cells which separate from each other in the centre so as to leave an axial space; though sometimes, in parts, the centre of the gland consists of a spongy mass of cells with no clear lumen. I could not distinguish the place where these glands discharge, nor their manner of opening. Around the base of the atrium there is also a quantity of loose cellular tissue; but glands and atrium are not contained within a capsule (*cf.* text-figure).

The ovaries are just dissolving. The egg-sacs, containing large yolky ova, extend back to segment xix.

The spermathecal duct is tubular, and somewhat wider near the body-wall than at its origin from the ampulla; its ental end is invaginated into the cavity of the ampulla. There are no gland-cells round the duct. The ampulla is an irregular sac, the outline of the cavity, as seen in sections, being made more irregular still by the varying thickness of the epithelial lining; there is a patent communication with the œsophagus.

#### *Remarks.*

The above species has some resemblance to *M. flavidus*, Mich. It is, however, considerably larger, and has a somewhat larger number of setæ per bundle; the vas deferens seems, from Michaelsen's figure, to be somewhat shorter in *M. flavidus*, and the characters of the spermathecal ampulla also differ. But the feature which apparently definitely distinguishes the two forms is the presence of four pairs of supernumerary septal glands in the Scottish worm; since, though no remark is made by Michaelsen on the glands, it would be impossible for him to have passed over so obvious a peculiarity if it had been present. *M. flavidus*, originally

recorded from Germany, has been found by Friend in Derbyshire.

*M. cellicus*, described by Southern from Co. Dublin and from near Edinburgh, also comes into consideration, on account of its possessing the peculiar character just mentioned—four additional pairs of septal glands. But the present worm differs from that one in (besides a number of less important features) the characters of the cœlomic corpuscles, in having fewer setæ in the ventral bundles, and especially in lacking the oval diverticulum of the base of the spermathecal ampulla which is present in *M. cellicus*.

### Genus FRIDERICIA, Mich.

#### *Fridericia ratzeli* (Eisen)?

Seaton Wood, Arbroath; under the surface of an old path. A single specimen, sexually mature.

#### *External Features.*

Length about 10 mm. Colour light grey. Segments 31, but possibly the hinder end has been mutilated at some previous time.

The prostomium is narrow and snout-like.

Dorsal pores begin in segment viii. and are situated a third of the length of the segment behind the intersegmental furrow. A head-pore is not distinct in the sections; but I think one is present between the prostomium and segment i.

The setæ have the characteristic arrangement of the genus; they are straight, of the Enchytræine type. In the ventral bundles there are apparently five, sometimes six, setæ in front of the clitellum, behind from three to six, often five; but the specimen was in a bad position for counting the numbers in the ventral bundles. In the lateral bundles there are five or six in front of the clitellum, four (the commonest number) to six behind, diminishing to three and two per bundle towards the posterior end.

The clitellum includes segments xii. and xiii.

#### *Internal Anatomy.*

The cœlomic corpuscles are small and irregular in shape.

Salivary glands are present, of some length, branched and extending back into segment iv. The "chyle cells," characteristic of the genus, are found in the alimentary epithelium in segments xii. and xiii., better marked in xiii. than in xii.

The dorsal vessel begins in segment xiii.

The anteseptal portion of the nephridia is of considerable size, and the lumen undergoes some windings in it before it passes the septum. The duct appears to be of a length equal to the postseptal portion, from the hinder end of which it is continued to the surface. But the plane of the sections is not very favourable for a determination of these relations.

There are large ventral ("copulatory") glands in segment xiii., but none elsewhere; they are one on each side of the nerve-cord, which they do not entirely cover dorsally.

The male funnels are only a little longer than broad (325 by 280  $\mu$ ), pear-shaped in form, narrowing rapidly towards the base, where the vas deferens originates. This latter, situated between the funnel and the penial body, is thin and coiled, and must be of some length. The penial body is of the Lumbricilline type, a relatively large (275 by 200  $\mu$ ), subspherical, cellular mass, surrounded by a muscular investment.

The spermathecal duct is a relatively long cylindrical tube, somewhat curved, definitely marked off from the ampulla by its more regular form and exceedingly narrow lumen. There are a few small groups of cells, perhaps gland-cells, in close proximity to the duct at a little distance from its ectal end. The narrow ampulla continues the duct towards the œsophagus, to which it is joined by a slender neck; the lumen of the ampulla penetrates the œsophageal wall for some distance, but I could not detect an actual opening into the cavity of the œsophagus.

Around the junction of the duct and ampulla are a number of diverticula, irregular thin-walled sacs, apparently four in number on one side of the body, and six on the other; but it is difficult to be sure of the number from the examination of serial sections.

#### *Remarks.*

The species with which the above worm most closely corresponds is *P. ratzei* (Eisen). This, however, appears to be a somewhat variable species—Friend (1914) calls it a "difficult species"; Southern (1909) says, "There is considerable uncertainty about the various descriptions of this species"; Welch (1917) points out the considerable deficiencies of previous descriptions.

The completest description by far is that of Welch (*loc. cit.*); but though the worm which I here describe corresponds fairly well with the diagnoses and shorter descriptions of earlier authors, it is certainly a different species from the

form described by Welch. Thus in the account of the latter author the peptonephridia (salivary glands) are said to be confined to segment v., while in mine they arise immediately behind the dorsal pad of the pharynx in segment iii. and extend back into segment iv.; the chylus cells of the intestine are in segments xiv.—xvi. in Welch's worm, in xii.—xiii. in mine; the penial body is almost as large as the male funnel in my specimen, but is very much smaller in Welch's worms; the ventral glands are confined to xiii. in the specimen above described, in xiii.—xv. in Welch's; and the male funnel, which in Welch's specimens is two to three times as long as broad (two to four times in Southern's), is in the worm which I describe above but little longer than broad. It must therefore be doubtful whether my worm, or Welch's, or neither, is really *F. ratzeli*.

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XI.—*Descriptions of Nine new Freshwater Fishes from French Guiana and Brazil.* By J. R. NORMAN.

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A LARGE collection of fishes chiefly from the Oyapock and Approuague Rivers, French Guiana, recently received from Dr. C. Ternetz, is of considerable interest, and contains examples of eight new species which are described below.

*Cretochanes cyrtogaster*, sp. n.

Depth of body about 3 times in the length, length of head 4 to 4½. Ventral profile distinctly convex. Snout shorter than eye, the diameter of which is 2½ to 2¾ in the length of head. Maxillary extending to below middle of eye, reaching posterior margin of second suborbital bone. 42 to 44 scales in a longitudinal series, 7 or 7½ from origin of dorsal to lateral line, 3 from lateral line to base of pelvis. Dorsal 11; a little nearer base of caudal than tip of snout. Anal 30–31

(28–29 branched rays) ; margin a little emarginate. Pectoral equal to or a little shorter than length of head, reaching pelvics or not quite so far. Silvery ; an indistinct lateral stripe on posterior half of body ; generally a diffuse black blotch at base of caudal, continued on to the lower rays of the upper caudal lobe.

Numerous specimens, measuring up to 95 mm. in total length, from the Oyapock River, French Guiana.

This species is very close to *C. melanurus*, Bloch, differing chiefly in the deeper body and the rather more numerous anal rays. The relations of the four Guiana species of *Creotochanes* are shown in the following synopsis :—

- |   |                            |
|---|----------------------------|
| I. Maxillary extending to below anterior margin of pupil or a little beyond, not reaching posterior margin of second suborbital ; 6 to 6½ (rarely 7) scales from origin of dorsal to lateral line ; anal with 30–34 rays (28–31 branched) . . . . . | [Günth.                    |
|   | 1. <i>caudomaculatus</i> , |
| II. Maxillary extending to below middle of eye, reaching posterior margin of second suborbital ; 7 to 7½ (rarely 8) scales from origin of dorsal to lateral line ; anal with 24–31 rays (22–29 branched).   |                            |
| A. Anal with 30–31 rays (28–29 branched) ; depth of body about 3 in the length ; a black blotch on base of caudal, continued on lower rays of upper caudal lobe . . . . .   | [sp. n.                    |
|   | 2. <i>cyrtogaster</i> ,    |
| B. Anal with 28–29 rays (25–27 branched) ; depth of body 3½ to nearly 4 in the length ; a black band on lower rays of upper caudal lobe . . .   | [Bloch.                    |
|   | 3. <i>melanurus</i> ,      |
| C. Anal with 24–28 rays (22–26 branched) ; depth of body 3½ to 3¾ in the length ; caudal dusky, base of each lobe yellowish . .   | 4. <i>affinis</i> , Günth. |

*Abramites microcephalus*, sp. n.

Depth of body  $2\frac{3}{4}$  in the length, length of head nearly 5. Eye nearer tip of snout than gill-opening ; diameter about equal to length of snout,  $3\frac{1}{2}$  in length of head,  $1\frac{1}{2}$  in inter-orbital width. Interorbital space very convex. Mouth terminal, width less than  $\frac{1}{2}$  that of head ; lips not fringed ; 3 teeth on each side of upper jaw. 36 scales in a longitudinal series,  $6\frac{1}{2}$  from origin of dorsal to lateral line, 6 from lateral line to base of pelvics. Dorsal 12 ; equidistant from tip of snout and base of caudal ; margin convex, the highest ray a little longer than head. Anal 13. Pectoral a little shorter than head, not nearly reaching pelvics, which are separated from anal by a distance nearly equal to their length. Caudal peduncle about as long as deep. Body with seven more or less broad, oblique, blackish cross-bands ; the two anterior in front of the dorsal, the third from base of dorsal to behind

pelvics, the last on base of caudal ; the third band continued on to dorsal fin as a triangular black patch margined with yellowish, which extends upwards to the tips of the anterior rays ; adipose fin yellow, with a black base ; pectorals, anal and caudal yellowish ; pelvics black.

A single specimen, 130 mm. in total length, from near the mouth of the River Amazon.

*Abramites ternetzi*, sp. n.

*Leporinus eques* (non Steindachner), Boulenger, Trans. Zool. Soc. xiv. 1896, p. 34.

Very close to *A. hypselonotus*, but with dorsal profile less convex in front of the dorsal fin, and caudal peduncle shorter. Depth of body  $2\frac{3}{4}$  to  $2\frac{1}{2}$  in the length, length of head nearly 4. Eye a little nearer tip of snout than gill-opening ; diameter greater than length of snout, nearly 3 in length of head, and almost equal to interorbital width. 37 to 38 scales in a longitudinal series,  $6\frac{1}{2}$  from origin of dorsal to lateral line, 6 from lateral line to base of pelvics. Dorsal 12 ; a little nearer base of caudal than tip of snout ; margin straight or a little convex. Anal 13. Pectoral a little shorter than head, nearly reaching pelvics, which are separated from anal by a distance equal to  $\frac{1}{2}$  or less than  $\frac{1}{2}$  their length. Caudal peduncle deeper than long. Oblique cross-bands arranged much as in *A. hypselonotus*\* and *A. microcephalus*, but more clearly defined ; the triangular dark brown patch on dorsal fin with a distinct white margin ; adipose fin black, with a white spot near the base ; anal dark brown, with a white band across middle of fin ; pelvics black ; pectorals and caudal yellowish.

Two specimens, 65 and 70 mm. in total length, from Sao Luis and Descalvados, Matto Grosso, Southern Brazil (*Dr. C. Ternetz*).

The genus *Abramites*, Fowler, differs from *Leporinus* chiefly in the deeper body, with the upper profile very convex before the dorsal fin, and in having the abdomen compressed to a sharp edge behind the pelvics. The four species may be distinguished as follows :—

- I. Anal with 13-14 branched rays ; cross-bands on body more or less vertical ..... 1. *eques*, Steind. ((Rio Magdalena.)
- II. Anal with 11 branched rays ; cross-bands on body oblique.
- A. Head nearly 5 in the length of body ;

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\* The types of this species are in bad condition, the markings being very indistinct.

- pelvics separated from anal by a distance which is nearly equal to their length . . . . . 2. *microcephalus*, sp. n. [(Lower Amazon.)
- B. Head nearly 4 in the length of body ; pelvics separated from anal by a distance which is not more than  $\frac{1}{2}$  their length.
1. Dorsal about equidistant from tip of snout and base of caudal ; caudal peduncle as long as deep, or a little longer than deep. . . . . 3. *hypselonotus*, Gunth. [(Upper Amazon.)
2. Dorsal a little nearer to base of caudal than tip of snout ; caudal peduncle deeper than long . . . . . 4. *ternetzi*, sp. n. [(Matto Grosso.)

*Leporinus spilopleura*, sp. n.

Depth of body  $3\frac{1}{3}$  to  $3\frac{2}{5}$  in the length, length of head a little more than 4. Eye a little nearer tip of snout than gill-opening ; diameter less than length of snout,  $3\frac{1}{2}$  to  $3\frac{3}{4}$  in length of head, nearly twice in interorbital width. Mouth terminal, width less than  $\frac{1}{2}$  that of head ; lips feebly fringed ; 4 teeth on each side of both jaws. 37 to 38 scales in a longitudinal series,  $5\frac{1}{2}$  from origin of dorsal to lateral line, 5 from lateral line to base of pelvics. Dorsal 12 ; about equidistant from tip of snout and base of caudal ; margin convex, the highest ray  $\frac{3}{8}$  length of head. Anal 10 ; margin subtruncate or rounded, third or fourth ray longest, scarcely reaching base of caudal when laid back. Pectoral nearly  $\frac{2}{3}$  length of head. Caudal forked. Caudal peduncle about as long as deep. Brownish above, paler below ; about twelve indistinct darker cross-bars on back and upper parts of sides ; a large black spot on lateral line above the pelvics, and another smaller one above the origin of the anal ; anal fin dusky, other fins lighter.

Two specimens, 160 and 165 mm. in total length, from the Oyapock River, French Guiana.

Close to *L. frederici*, Bloch, differing chiefly in the smaller head and shorter snout, more anterior position of the dorsal fin, form of the anal fin, and in the coloration.

*Leporinus melanostictus*, sp. n.

Depth of body about 3 in the length, length of head  $3\frac{1}{3}$  to 4. Eye slightly nearer gill-opening than tip of snout ; diameter about  $1\frac{1}{2}$  in length of snout,  $3\frac{1}{2}$  to 4 in head,  $1\frac{2}{3}$  to  $1\frac{3}{4}$  in interorbital width. Mouth terminal or subterminal, width a little more than  $\frac{1}{3}$  that of head ; lips feebly fringed ; 3 teeth on each side of upper jaw. 34 or 35 scales in a longitudinal series, 5 or  $5\frac{1}{2}$  from origin of dorsal to lateral

line, 5 from lateral line to base of pelvics. Dorsal 12; nearer base of caudal than tip of snout; margin convex, highest ray  $\frac{3}{4}$  to  $\frac{5}{8}$  length of head. Anal 10; margin straight or slightly emarginate, longest rays not quite reaching base of caudal when laid back. Pectoral about  $\frac{3}{4}$  length of head. Caudal forked. Caudal peduncle as long as deep or a little deeper than long. Brownish or blackish above, paler below, each scale with a dark spot at the base; a dark blotch above axil of pectoral; fins yellowish, anal tinged with dusky.

Four specimens, 120 to 175 mm. in total length, from the Approuague and Oyapock Rivers, French Guiana.

*Corydoras spilurus*, sp. n.

Depth of body  $2\frac{3}{8}$  to 3 in the length, length of head  $3\frac{1}{2}$  to  $3\frac{3}{4}$ . Snout  $1\frac{1}{2}$  to  $1\frac{5}{8}$ , diameter of eye  $4\frac{1}{2}$  to  $4\frac{3}{4}$ , interorbital width about 3 in length of head; snout much longer than postorbital part of head. Suborbital narrow, its depth about 3 times in distance from upper lip; barbel not quite reaching gill-opening. Dorsal 17; spine about  $\frac{3}{4}$  length of head; first and second soft rays longest, about  $1\frac{1}{2}$  times as long as spine; base a little more than distance from adipose fin, which is preceded by 3 median scutes. Anal 16. Caudal deeply emarginate. Pectoral spine  $\frac{3}{4}$  to  $\frac{5}{8}$  length of head, extending to base of pelvics or a little beyond. Scutes 22-23/21-22; humeral shields not in contact below, each separated by one or two scutes from base of pelvic fin. Young specimens with irregular series of dark spots and blotches on side, which disappear almost completely in the adults; generally a few small spots on posterior rays of dorsal and on the anal fin; caudal barred with series of small spots; other fins immaculate.

Eight specimens, 33 to 70 mm. in total length, from Iponcin Creek, into Approuague River, French Guiana.

This species appears to be most nearly related to *C. treitlii*, Steindachner, from the River Parnahyba, differing in the shorter head and snout, shorter barbels, and in the coloration.

*Plecostomus gymnorhynchus*, sp. n.

Depth of body  $4\frac{1}{4}$  in the length, length of head a little more than 3. Depth of head  $1\frac{1}{2}$  times in its length, breadth of head  $1\frac{1}{4}$  times, length of snout  $1\frac{3}{4}$  times, diameter of eye about 6 times, interorbital width  $2\frac{1}{2}$  times. Length of mandibular ramus 3 times in interorbital width; about 18



teeth on each side in both jaws. Barbel about  $\frac{3}{4}$  diameter of eye. Snout obtuse, scarcely narrowed anteriorly; supra-orbital margins scarcely raised; supraoccipital not elevated posteriorly, without median ridge, bordered posteriorly by a single scute; occipital process moderate; temporal plates weakly keeled. Scutes spinulose, the anterior and upper scutes carinate, 26 in a longitudinal series, 7 between dorsal and adipose fin, 12 between anal and caudal. Lower surface of head naked except for some granular scales on upper lip and in front of gill-openings; snout with a rather broad naked margin; abdomen in great part naked, some granular scales laterally, and forming an incomplete strip between the bases of the pectorals. Dorsal 17; the first ray a little shorter than head, when laid back extending to the second scute behind the last ray, which is  $\frac{1}{2}$  as long as the first; length of base of dorsal equal to its distance from tip of spine of adipose fin. Anal 14. Pectoral spine extending to anterior  $\frac{1}{4}$  of pelvic fin. Caudal rather deeply emarginate, the middle rays a little more than  $\frac{1}{2}$  as long as the longest. Caudal peduncle  $3\frac{3}{4}$  times as long as deep. Numerous dark spots on head, body, and on the hinder  $\frac{2}{3}$  of the dorsal fin; caudal fin irregularly barred with series of dark spots, the lower ray plain.

A single specimen, 200 mm. in total length, from Iponcin Creek, into Approuague River, French Guiana.

This species differs from most other members of the genus in the form of the snout, with a naked margin, a character in which it approaches the genus *Hemipsilichthys*. In the position of the dorsal fin, however, and in the form of the teeth, it agrees with other species of *Plecostomus*.

*Hemiancistrus niger*, sp. n.

Depth of body about 6 in the length, length of head 3 to  $3\frac{1}{2}$ . Head nearly as broad as long and  $1\frac{1}{5}$  to twice as long as deep. Diameter of eye  $6\frac{1}{2}$  to  $6\frac{3}{4}$  times in length of head, interorbital width about 3 times, length of snout  $1\frac{1}{2}$  to  $1\frac{3}{4}$  times. Length of mandibular ramus  $1\frac{1}{4}$  to  $1\frac{1}{2}$  in the interorbital width. Snout broad, depressed, rounded or obtusely pointed anteriorly, without naked margin; adults with a patch of bristles on each side of the snout, which are very small in the female and much shorter than the diameter of the eye in the male; supraorbital margins scarcely raised; supraoccipital flat, without median ridge, margined posteriorly by a median scute and by one on each side; temporal plates

not carinate; interoperculum armed with 30 or more rather slender spines with curved tips, the inner longest, a little longer than diameter of eye. Scutes spinulose, not carinate, 24 to 25 in a longitudinal series, 5 or 6 between dorsal and adipose fin, 10 or 11 between anal and caudal. Lower surface of head and abdomen naked. Dorsal 17; base as long as its distance from tip or posterior part of spine of adipose fin; the first ray  $\frac{4}{5}$  to  $\frac{5}{8}$  length of head, the last scarcely reaching adipose fin when laid back. Anal 14-5. Pectoral spine extending to a little beyond middle of pelvic fin in adults. Caudal obliquely emarginate. Caudal peduncle about 3 times as long as deep. Head, body, and fins blackish, young with or without a few light spots; the first ray of the dorsal, pectoral, and pelvic fins, and the upper and lower rays of the caudal tipped with white.

Five specimens, 105 to 200 mm. in total length, from the Oyapock River at "Sant" Cafesoca, French Guiana.

Allied to *H. megacephalus*, Günther, differing chiefly in the broader and more depressed snout, smaller eye, and longer caudal peduncle.

*Crenicichla ternetzi*, sp. n.

Depth of body 5 or a little more than 5 in the length, length of head  $3\frac{1}{2}$  to  $3\frac{1}{4}$ . Diameter of eye  $5\frac{3}{4}$  to 7 in length of head, length of snout about 3, interorbital width  $3\frac{1}{2}$  to  $3\frac{3}{4}$ . Nostril much nearer to eye than to extremity of snout. Maxillary not extending to below the eye; depth of pre-orbital  $\frac{3}{4}$  to  $\frac{1}{2}$  the diameter of eye. Anterior teeth forming 7 or 8 series in the upper jaw, 4 in the lower. 10 or 11 gill-rakers on lower part of anterior arch. Scales denticulated, except on head, thorax, abdomen, and above upper lateral line; 82 to 86 in a longitudinal series below lateral line, 7 or 8 from last dorsal spine to lateral line, 3 between upper and lower lateral lines. Lateral line 26-27 + 11-13. Dorsal XXIII-XXIV 13-14; last spine  $3\frac{1}{4}$  to  $3\frac{1}{2}$  in the length of head. Anal III 9-10. Pectoral about  $\frac{1}{2}$ , pelvics less than  $\frac{1}{2}$  length of head. Caudal peduncle about as deep as long. Greyish brown, with a more or less distinct dark longitudinal band from eye to extremity of caudal; upper part of body sometimes with faint traces of dark cross-bars; vertical fins blackish, with a pale intramarginal band.

Three specimens, 160 to 200 mm. in total length, from the Oyapock River at "Sant" Cafesoca, French Guiana.

Near *C. multispinosa*, Pellegrin, differing chiefly in the larger scales and in the coloration.

XII.—*Brief Descriptions of new Thysanoptera*.—XV.

By RICHARD S. BAGNALL, F.R.S.E., F.L.S.

THIS is continued from Ann. & Mag. Nat. Hist. ser. 9, xiv. pp. 625–640, Dec. 1924, and will be shortly followed by Part XVI. The following new genera and species belonging to the THRIPOIDEA are described:—

- Brachyurothrips indicus*, sp. n.  
*Euhydatothrips nigripennis*, gen. et sp. n.  
*Frankliniella africana*, sp. n.  
*Physothrips ignobilis*, sp. n.  
 — *uniformis*, sp. n.  
 — *myrsinicola*, sp. n.  
 — *spiranthidis*, sp. n.  
 — *gowdeyi*, sp. n.  
 — *immsi*, sp. n.  
*Stenchatothrips melænurus*, gen. et sp. n.  
*Thrips versicolor*, sp. n.  
 — *fortis*, sp. n.  
 — *pallipes*, sp. n.  
 — *immsi*, sp. n.  
 — *inaginis*, sp. n.  
 — *melanurus*, sp. n.  
 — *pusillus*, sp. n.  
*Microcephalothrips*, gen. nov.

## Suborder TEREBRANTIA.

## Superfamily THRIPOIDEA.

*Brachyurothrips indicus*, sp. n.

♀.—This species differs from *B. anomalus*, Bagn., in several particulars, but unfortunately the material at my disposal is both scanty and imperfect.

Colour much as in *anomalus*. The abdomen is dark with segment 9 (broader than in *anomalus*) yellowish-brown and 10 light yellow. All femora are yellowish-brown, the fore-tibia whitish-yellow to yellow, and the intermediate and hind-tibiæ yellowish-brown but pale in the distal third or thereabouts with all tarsi yellow.

The cheeks of the head are slightly arcuate behind eyes, and then angularly swollen before a rapid basal constriction.

One lightly-coloured specimen has one of the antennæ indifferently displayed; the basal segments are pale yellow and the succeeding segments even paler, almost colourless. Joint 3 seems to be swollen medianly with constricted stem and short distal production; 4 is ovate in the basal three-fifths and with a narrowed distal production, 5 broadens

from base distally, 6 is short and broad, but 7 and 8 (presumably) are not observable in this preparation.

Wings reaching to about the seventh abdominal segment, fore-wings without veins, but indications of upper and lower (the former close to costa) in the form of a series of 7 and 10 setæ respectively. Costa with a few widely-spaced bristles (13, including 3 basal), the longest being no more than twice the wing-breadth and shortening to distal end of wing; costal cilia fine, sparse, 2 between each 2 costal setæ in the distal end, 3 between each 2 in the basal half. Cilia of the lower margin close, exceptionally long and wavy.

*Hab.*—INDIA, Calcutta, salt marsh, 8. iii. 14 (*T. Bainbrigge-Fletcher*), no. 76, 2 ♀ ♀.

*Heliothrips longiceps*, Karny.

*Hab.*—FIJI, Lautoka, 1 ♀ on grass (*H. Greenwood*), 4. iv. 19, I.B.E. no. 167.

Previously known from a single female example described from New Britain.

Genus EUHYDATOTHRIPS, nov.

As in *Hydatothrips*, Karny, but with the maxillary palpus only 2-jointed and pronotum furnished with a bristle at each hind-angle.

Type. *Euhydatothrips nigripennis*, m.

*Euhydatothrips nigripennis*, sp. n.

♂.—Length about 0.95 mm., slender, legs long and slender.

Colour lemon-yellow; legs pale; head around eyes (which are black) and across dorsum a deep rich brown. Wings entirely of a deep brown. Antennæ brown, joints 3 and 4 entirely and 5 basally pale yellow; apical joint pale distally. Head slightly longer than pronotum, dorsum reticulate. Antennæ Heliothripid, joint 2 massive; 3 stemmed basally, roundly swollen and then constricted distally; 4 with stem shorter and swollen part longer; 5 roundly claviform; 6 short and oviform; 7 short and 8 bristle-like. Lengths (and breadths) of segments 3 to 8 respectively as follows:—

$\mu$  65 (20) : 52 (19) : 41 (17.5) : 27 (16) : 9 : 32.

Maxillary palpi 2-jointed, with distal joint longer than the basal.

Reticulated structure of the pronotum apparently dorsal. Fore-wings much as in *Hydatothrips adolfi-friderici*, Karny; costa with a series of sparsely set pale bristles and cilia; lower cilia dark, close, and wavy.

The unique example is mounted laterally and therefore difficult to describe. In its type and coloration it is a beautiful and distinctive form.

*Hab.*—E. AFRICA, Arusha, Oct.–Nov. 1905, 1 ♂.

*Frankliniella africana*, sp. n.

♀.—Much as in *nigriventris*, Uzel, but differing chiefly in the larger ocelli, which have the inter-ocular bristles shorter and more closely set between the posterior ocelli instead of on a line above them. The postocular setæ are nearly twice as long as in *F. nigriventris*. The head (and pronotum also) is wider compared with the length, whilst the pronotal bristles at anterior angles are slightly shorter and the inner pair distinctly longer. The terminal abdominal bristles are shorter than in *nigriventris*.

The relative lengths (and breadths) of the antennal joints 3–8 are as follows:—

*F. nigriventris*, Uz.:

$\mu$  43 (21) : 43 (20) : 38 (17) : 45 (19) : 9 : 16.

*F. africana*, sp. n.:

$\mu$  46 (21.5) : 46 (20) : 38 (19) : 50 (20) : 9 : 15.

The following further comparative measurements in microns are useful, those referring to *nigriventris* being taken from a preparation kindly presented to me by Priesner:—

	<i>F. nigriventris</i> .	<i>F. africana</i> .
Length of inter-ocular bristles . . . . .	46	38
Width between them . . . . .	24	14
Length of post-ocular bristles . . . . .	17	32
Pronotum, length of		
(a) Outer anterior bristles . . . . .	68	60
(b) Inner " " . . . . .	35	46
(c) Outer posterior bristle . . . . .	62	62
(d) Inner " " . . . . .	76	70
(e) Median " " . . . . .	35	35
Terminal abdominal bristles . . . . .	135	116

♂.—Smaller. Lateral bristles stout, but not so stout as in many species; specialized setæ of tergite 9 consisting of 3 pairs, the outer and intermediate being on the same plane

and the inner on a lower plane, the relative lengths being approximately as follows:—

Outer .....	24	separated by	76 $\mu$
Intermediate .....	66	„ „	38 $\mu$
Inner .....	20	„ „	11 $\mu$

*Hab.* W. AFRICA, Gold Coast, Aburi, 1 ♀ from flower of *Strophanthus gratus* and 1 ♂ from flower of *Solanum wendlandii*, Nov. 1915. Reg. 277 and 267 respectively (*W. H. Patterson*, per I.B.E.).

The specimens are unfortunately cleared, but are sufficient to indicate a type of coloration much as in *F. nigriventris*.

### Genus *PHYSOTHRIPS*, Karny.

The arguments brought forward by Hood in 'The Entomologist,' lviii. (June 1925), for the invalidation of this name are based upon the assumption that *ulmifoliorum*, Haliday, was named as the type, whereas the type designated was *what was believed by European authors* to be *ulmifoliorum* (= *ulmifoliorum*, Uzel (nec Hal.) = *obscurus*, Uz., or *salicis*, Reuter). Later European authors were proved in error, the true *ulmifoliorum* of Haliday turning out to be a species of *Oxythrips*! Thus more remains to be written on this subject; for myself, I restrict the name *Tæniothrips* for a very limited section comprising *primulæ*, Hal., *inconsequens*, Uz., *major*, Bagn., and two other South European species I am shortly describing, whilst Karny apparently includes the *usitatus*, Bagn., group. Neither is satisfactory, but further material and study will no doubt help workers to attach proper values to three or four sections which appear to merit generic distinction.

The following four Australian species are characterized by having the upper vein of the fore-vein uniformly set with setæ for the whole length:—

#### *Physothrips setipennis*, Bagnall.

*Hab.* AUSTRALIA, Ben Cairn near Healesville, Victoria, on *Sambucus gandichaudiana*, 17.i.1926 (*R. Kelly*).

#### *Physothrips ignobilis*, sp. n.

♀.—Length 1.1 mm. as compared to 1.3 to 1.4 in the above-recorded *setipennis*, Bagn.

Colour as in *setipennis* (having all tibiae yellowish as in

that species), from which it differs in its much smaller size, the relative lengths of the antennal segments, and the smaller number of wing-spines.

The relative lengths (and breadths) of the antennal joints 3-8 are :—

*P. setipennis*, Bagn. :

$\mu$  65 (23) : 63 (22) : 38 (17) : 55 (19) : 7 : 8.5.

*P. ignobilis*, sp. n. :

$\mu$  54 (22) : 49 (21) : 33 (17) : 51 (19) : 6 : 7.

The number of setæ along the costa, upper vein, and lower vein of fore-wing are 22-24, 16-18, and 13-15 respectively as compared with 27-29, 20-22, and 16-18 in *P. setipennis*. The posterior margin of the eighth abdominal tergite is fringed as in *P. setipennis*, but the microsetæ are shorter, apparently measuring but 0.008 mm. as compared to 0.012 to 0.013 mm. in *setipennis*.

The species would appear to differ from *chaetoneurus*, Karny (1920, Acta Soc. Ent. Cech. xvii.), but Karny (who compares the wings of *chaetoneurus* with those of *meruensis* and *fumosus*, Tryl.) has not amplified his original brief description.

*Hab.* AUSTRALIA, Warburton, Victoria, 2 ♀ ♀ on *Myrsine variabilis*, 17.i.1926 (R. Kelly).

*Physothrips uniformis*, sp. n.

♀.—Length about 1.1 mm.

This species is sharply separated from *seticollis*, Bagn., *setipennis*, Bagn., *ignobilis*, sp. n., and *chaetoneurus*, Karny, by the colour of the antennæ and shape of the small third and fourth antennal joints and from the first three at least by its shorter and relatively broader head and the uniformly dark brown fore-wings. The tibiæ are only slightly less shaded with grey-brown than the femora, whilst the antennal joints 1 and 3 are pale grey-brown and 4 a shade darker but pale basally, whilst 2, 5 (except for extreme base), and the succeeding are dark blackish brown. The postero-lateral bristles are somewhat slender with the outer shorter than the inner (8 as to 10), which latter is 0.4 the length of the pronotum. The postero-marginal series consists of three minute pairs in addition to the well-developed inmost-pair, which are approximately 0.75 the length of the outer postero-lateral bristle.

The head is transverse and about 0.7 as long as broad

(102 : 150  $\mu$ ). Antennal joint 3 is feebly claviform, almost fusiform, whilst 4 is not unlike 3 in shape, but might be more correctly described as fusiform, and both are noticeably small in comparison with 2. The relative lengths (and breadths) of joints 2 to 8 are as follows :—

34 (24) : 42 (18) : 38 (17) : 31 (16) : 7 : 18.

The number of setæ along the costa, upper vein, and lower vein of fore-wing is 23–24, 16–18, and 14–15 respectively.

The abdomen has the posterior margin of tergite 8 fringed, whilst segment 10 (nearly twice as long as 9) is divided above for its whole length. Apical bristles on 10 weak and those on 9 longer and stronger, the longest being about 2.0 times as long as the segment itself.

*Hab.* AUSTRALIA, Ben Cairn near Healesville, Victoria, ♀ ♀ on *Senecio dryadeus*, 17. i. 1926 (*R. Kelly*).

*Physothrips myrsiniicola*, sp. n.

Although this species is described from a single ♂, actually a ♀ was included in the material, which agreed closely in colour and form of antenna with the ♂, so, though this ♀ example vanished most mysteriously and inexplicably whilst being treated for mounting, we know that we are dealing with a yellow species.

♂.—Length about 0.9 mm.

Colour yellow as in *Thrips flavus*, which it superficially resembles; wings pale greyish-yellow; eyes black and ocelli with crescentic crimson hypodermal pigmentation. Antenna with joint 1 colourless, 2 and 3 yellowish, the following dark greyish-brown with base (or extreme base) of 4 and 5 pale. All setæ greyish-brown, slender.

Relative lengths of antennal segments 3 to 8 approximately 56 : 52 : 35 : 52 : 5.5 : 7  $\mu$ . Setæ of fore-wing somewhat long and fine, those on costa, upper vein, and lower vein 22, 3+10, and 14–15 respectively.

Abdomen with the specialized setæ of tergite 8 consisting of two pairs of long bristles, the inner pair on a higher plane than the outer, with a third (and outmost) shorter pair on the same plane as the inmost pair.

*Hab.* AUSTRALIA, Warburton, Victoria, 1 ♀ and 1 ♂ on *Myrsine variabilis* with *P. ignobilis*, sp. n.



*Physothrips xanthoceros*, Hood.

1916. The Canadian Entomologist, xlviii. p. 130, fig.

Described from a single example on coffee at Kisube, Uganda (Gowdey), with *P. antennatus*, Bagn.

*Hab.* TANGANYIKA TERR., Kilimanjaro, ii. & iii. 1923, ex coffee, A. H. Ritchie, T.T. 278, I.B.E. no. 169, ♀ ♀ only.

*Physothrips ventralis*, Hood.1918 (Apl. 10). *Physothrips ventralis*, Hood, Insec. Inscut. Menstr. vi. nos. 4-6.1918 (May). *Physothrips marshalli*, Bagnall, Bull. Ent. Res. ix. p. 66, figs. 1 a 1 d.*Physothrips kellyanus*, Bagn.

In the antennal antigeny of the sexes this species might more properly be referred to the genus *Rhopalandrothrips*. The relative lengths (and breadths) of the antennal joints in the ♂ as compared with the common European species *R. obscurus* are as follows :—

*P. kellyanus*, Bagn. :

62 (23) : 58 (21) : 35 (16) : 89 (20) : 8 : 13.

*P. obscurus*, Uzel :

33 (20) : 24 (20) : 15 (19) : 157 (20) : 3·5 : 6·5.

The following are further records :—

*Hab.* AUSTRALIA, Hawthorn, Victoria, 1 ♀ and 1 ♂ on dahlia, 9. ii. 23; Ballarat, Victoria, 1 ♂ on *Hypochaeris radicata* with *Thrips imaginis*, m., 18. 1. 15; Melbourne, Botanic Gardens, 1 ♀ on *Backhausia citriodora*, 10. ii. 23; 2 ♂ ♂ on *Banksia æmula*, 20. ii. 23 (*R. Kelly*).

*Physothrips spiranthidis*, sp. n.

♀.—Length 1·5 to 1·6 mm.

Colour of a deep blackish-brown including all antennal segments; all tarsi pale and tibiae inclined to be pale distally. Antennal joints 4 and 5 with a pale ring near extreme base.

Wings dark brown with a light area in the basal sixth or thereabouts excluding scale. Upper vein with a basal series of 7-8 bristles (1+4+3, 1+5+1, and 1+4+2+1 in three wing-counts) in the basal two-fifths or thereabouts; a single seta just beyond middle and 4 to 6 within the distal fourth

to third. Costa and lower vein with 28-29 and 13-14 setæ respectively.

Length of head (and greatest breadth) 140 (214)  $\mu$ .

Length of pronotum (and greatest breadth) 157 (270)  $\mu$ .

Length (and breadth) of antennal joints 3-8 as follows:—

81 (30) : 71 (27) : 43 (22) : 57 (20) : 11 : 16  $\mu$ .

Trichomes long and slender. Interocellar setæ situated immediately above the posterior ocelli, short and stout (32  $\mu$ ).

Postero-angular pronotal bristles also short, outer 38 and inner 50  $\mu$ ; postero-marginal setæ consisting of 3 minute pairs, the innermost widely separated (by 54  $\mu$ ). Posterior margin of abdominal tergite 8 closely and stoutly fringed; length of abdominal segments 8, 9, and 10 respectively 92, 89, and 76  $\mu$ , and bristles on 9 and 10 approximately 150  $\mu$  in length.

Easily separated from *P. atratus* (Hal.) by the short wing, inter-ocellar and pronotal bristles, and the chaetotaxy of the wings.

*Hab.* AUSTRALIA, Victoria, Mt. Yule, Healesville, on Spiral Orchid (*Spiranthes australis*), 28. i. 23, 2 ♀ ♀ only (*R. Kelly*). Mr. Kelly adds that the larvæ when taken were bright red.

*Physothrips gowdeyi*, sp. n.

♀.—Length 1.0 mm.

Colour brown, head and abdomen inclined to be darker than the thorax; fore-legs yellowish-brown, fore-wings brown, paler at base, cilia and median vein of hind-wing grey-brown. Antennæ brown, joint 3 and base of 4 indefinitely yellowish-brown.

Head about 0.72 as long as broad, eyes prominent, coarsely faceted, pilose and occupying about 0.6 the length of the head. Cheeks arcuate, swelling from eyes; dorsal surface broadly transversely striate behind eyes; ocelli large, apparently no prominent inter-ocellar or postocular bristles, but a transverse series of setæ behind eyes, with the inmost pair situated immediately under the posterior ocelli. Antennæ more than twice as long as the head, joints 3 and 4 fusiform, the former pedicellate, 5 short and slender. Length (and breadth) of antennal joints 3 to 8 approximately as follows:—

$\mu$  44 (20) : 38 (19) : 30 (16) : 46 (19) : 5 : 10.

Mouth-cone reaching almost across prosternum; maxillary palpi long, distal joint longest, slender.

Pronotum about 1·25 times as long as the head and 0·7 as long as broad; surface broadly transversely striate and sparingly setose; bristles at posterior angles short, somewhat stout, the outer about 0·3 the median length of pronotum with a minor seta situated between them; a postero-marginal series of 4 pairs, the inmost pair longer than the others and about 0·5 the length of the outer post-angular pair. Pterothorax quadrate. Wings rather short, fore-wings 2·6 times as long as the width of the pterothorax and about 13 times as long as broad near middle; setæ short, dark, those on costa and lower vein near middle a little longer than 0·5 the breadth of wing. Costa with 22 and lower vein with 13-14 setæ respectively; distal half of upper vein with 1+1+1 or 1+2 setæ.

Abdomen elongate, only a little broader than the pterothorax; apical bristles long, those on 9 longer than and those on 10 about 1·5 times as long as the segments bearing them; 9 split dorsally for 0·8 its length. Fringe of eighth tergite sparing, varying in length from 0·005 to 0·008 mm. and not interrupted in middle.

Length (and breadth) of head, pronotum, and pteronotum 86 (118), 108 (154), and 205 (216)  $\mu$  respectively. Length of fore-wings 553; greatest width of abdomen 230, length of segments 8, 9, and 10, 68, 62, and 45  $\mu$  respectively.

This species closely approximates two recently described African species, *Teniothrips modestus* and *T. debilis*, Hood, but is distinguished from both in the longer sixth antennal joint and more slender form; more closely approaching *debilis* than *modestus*, from which it also differs in its coloration and with the apical bristles longer than segment 8.

*Hab.* AFRICA, Uganda, Kampala, 2 ♀ ♀ from *Solanum* sp., 11. xi. 1917 (C. C. Gowdey), I.B.E. 127.

*Physothrips immsi*, sp. n.

♀.—About 1·0 mm. Excepting for the greater breadth and diverging head and pronotum much as in *P. gowdeyi*; brown, all tarsi and all tibiæ distally and third antennal joint yellowish. Head much as in *gowdeyi*, but shorter, more transverse and strongly divergent posteriorly, and about 0·65 as long as broad. Antennæ more than twice as long as the head, relative lengths (and breadths) of joints 3 to 8 approximately as follows:—

$\mu$  38 (19) : 35 (19) : 29 (17) : 41 (18) : 5 : 8.

Pronotum 1·4 times as long as the head, also divergent

posteriorly where it is broadest and 1.5 times as broad as long. Outer and inner postero-angular bristles (with a minor seta between) short and approximately 0.25 and 0.35 the length of the pronotum respectively; postero-marginal setæ consisting of 5 pairs. Pterothorax quadrate. Wings long, though only 2.5 times as long as the breadth of the pterothorax, about 1.4 times as long as broad near the middle. Costa and lower vein with 19-23 and 10-13 setæ respectively which are about as long as the breadth of wing near middle. Abdomen broad, acutely pointed at apex; segment 10 split for 0.75 its length; bristles on 10 rather weak and only about as long as that segment. Tergite 8 with fringe longer and less sparse than in *P. gowdeyi*, from 0.007 to 0.011 mm. long and not interrupted medianly.

Length of head, pronotum, and pteronotum 80 (123), 116 (178), and 260 (240)  $\mu$  respectively. Length of forewings 608, greatest width of abdomen 280, length of segments 8, 9, and 10, 59, ? 44, and 48  $\mu$  respectively.

♂.—Smaller than ♀, all tibiæ (except basally), tarsi, and antennal joints 2 and 3 yellowish. Head and pronotum not so markedly divergent posteriorly. A broad rectangular depression much as in *Baliothrips dispar* on sternites 3 to 6 only, that on 3 greatest (0.046 mm. broad) and on 6 least (0.024 mm.). The specialized setæ of tergite 9 consisting of 2 pairs of long slender bristles subequal in length (about 0.033 mm.) the outer pair on a lower plane nearer the posterior margin of tergite separated by about 0.035 and the inner pair by about 0.022 mm.

Sternites, from 5 to 8 at least with the posterior margins produced into irregular fringed areas indented at their separation, the median one being the broadest.

*Hab.* INDIA, near Bhowali Kumaon, on *Clematis* sp. at 5700 ft., Oct. 1909 (*A. D. Imms*).

#### Genus STENCHÆTOTHRIPS, nov.

Head nearly as long as broad and longer than the pronotum; maxillary palpi long and slender, 3-jointed, the distal joint longest. Pronotum transverse with two long fine bristles at each hind angle and two long pairs on the anterior margin, the one near angles the longer.

Abdomen not broader than the pterothorax, segments 9 and 10 pointed as in *Oxythrips*. Wings as in *Anaphothrips*.

The antennæ are unfortunately missing, but the genus has most probably *Anaphothrips*, *Bregmatothrips*, and *Oxythrips* affinities.

Type. *Stenchætothrips melanurus*, m.

*Stenchaetothrips melanurus*, sp. n.

♀.—Length about 1.1 mm.

Colour pale yellow, eyes black and ocelli with red hypodermal pigmentation; abdominal segments 9 and 10 dark blackish-brown.

Pronotal setae very slender, colourless; those of posterior angles 0.4 to 0.5 and the outer antero-marginal 0.3 the length of pronotum. Wings lightly fumate, cilia brownish, bristles pale, rather long and slender, those on distal part of upper vein sparing; lower cilia close and wavy.

I have withheld naming this conspicuous species for many years in the hopes of obtaining further material.

*Hab.* AFRICA, Khartoum; 2 ♀ ♀ (imperfect) on Green Tura, 23. viii. 1910 (*King*).

*Pseudanaphothrips achætus* (Bagn.).

This species' affinities lie with *Pseudothrips* and *Glaucothrips* rather than with *Anaphothrips*. The following are further records:—

*Hab.* AUSTRALIA, Burnley-on-Yarra, Victoria, on Pennyroyal, 21. i. 23, and Botanic Gardens, Melbourne, on *Backhausia citriodora*, 10. ii. 23, ♀ ♀ only (*R. Kelly*).

*Thrips versicolor*, sp. n.

♀.—Length 1.1 to 1.2 mm.

Form stout. Head and thorax golden yellow lightly shaded with grey; all legs pale greyish-white; abdomen of a uniform dark blackish-brown. Antennae with joints 1 and 3 greyish-yellow, 2 brown and 4–7 greyish-black, 4 pale basally and 5 pale at extreme base. Fore-wings and cilia smoky grey, apparently pale in basal third or thereabouts; bristles dark. Eyes black, ocelli with crimson hypodermal pigment.

Head transverse, about 0.7 as long as broad and about as long as the pronotum. Eyes moderately coarsely faceted, pilose. Inter-ocellar bristles and series behind eyes and posterior ocelli moderately long and slender. Maxillary palpi 3-segmented; mouth-cone reaching more than half-way across prosternum. Antennae long and slender, about 2.3 times as long as the head; relative lengths (and breadths) of segments 2 to 7 as follows:—

38 (24) : 55 (20) : 54 (19) : 40 (17) : 54 (18) : 16  $\mu$ .

Sense-cones long and slender.

Pronotum transverse, setæ at hind angles dark and stout, more than 0.5 as long as the median length of the pronotum. Wings reaching to abdominal segment 9; fore-wings pointed at ends, veins well-defined; setæ long, as long as or longer than the breadth of the wing near middle, difficult to count but apparently with more than 20 and 12 (or more) along the costa and hind vein respectively and upper vein with two distal setæ near tip. Tergite 8 apparently without "comb," if present, very short and minute, but impossible to say with certainty from the material at my disposal. Apical abdominal bristles long and moderately strong.

In its general appearance the species is very like *Platythrips tunicata*, Hal., and appears to come near *magnipes*, Schmutz, which is, however, a broader insect with the posterior ocelli widely spaced and having three bristles in the distal half of the upper vein of fore-wing.

*Hab.* FIJI, Tamavui, 2 ♀ ♀ from banana, l. x. 24 (Campbell, 1249); I.B.E. no. 147.

*Thrips fortis*, sp. n.

♀.—Length about 1.0 mm.

Form stout. Colour yellow, end of abdomen, segments 9 and 10, wing-cilia, and mouth-cone distally shaded with brown. Eyes deep purplish-black. Fore-wings grey and legs shaded with grey to greyish-brown on their outer margins. Antennæ brown, 3 basal segments yellowish shaded with grey to greyish-brown, especially 2 wholly and 3 distally.

Head transverse, 0.6 as long as broad and about as long as the pronotum. Antennæ about 2.25 times as long as the head with the relative lengths of the segments as follows:—22 : 35 : 48 : 43 : c. 33 : c. 46 : 14  $\mu$ . Segments 3–6 subequal in breadth, somewhat slender apparently 0.016 mm. broad as compared to 0.024 in joint 2.

Eyes occupying about 0.6 the length of the head; posterior ocelli widely separated and contiguous to the inner margins of the eyes; inter-ocellar setæ short and situated on a line below and close to the anterior ocellus. Maxillary palpi 3-segmented, long; length of segments 11, 8, and 16  $\mu$ .

Pronotum transverse, about 0.6 as long as broad; postero-angular bristles brown, the inner longer than the outer (43 and 30  $\mu$  respectively) and about 0.4 the length of the pronotum; postero-marginal series of 4 pairs of short subequal pale setæ. Legs short and broad, length (and breadth) of the anterior, intermediate, and posterior tibiæ

respectively 108 (43), 100 (40), and 162 (40)  $\mu$ . Pterothorax quadrate; wings long, the upper pair about 12 times as long as broad near middle; distal 0.4 of upper vein with 1 + 1 + 1 setæ, costa and lower vein with 28 and 17 setæ respectively, which are somewhat short.

Abdomen broadly ovate, apical bristles short, those on 9 but slightly longer than segment 10.

Length (and breadth) of head, pronotum, and pteronotum 102 (162), 108 (190), and 216 (244)  $\mu$  respectively. Length of wing 612, of outer and inner posterior angular pronotal bristles 30 and 43, and of longest abdominal bristles on segments 9 and 10 72 and 80  $\mu$  respectively. Breadth of abdomen near middle about 296  $\mu$ .

*Hab.* AUSTRALIA, Melbourne, Botanic Gardens, 1 ♀ on Canna, 13. ii. 23 (*R. Kelly*).

*Thrips albipes*, Bagn.

*Hab.* INDIA, Dehra Dun, 1 ♀ in flower of *Eriobotrya japonica*, Jan. 1, 1912; near Bhowali Kumaon, 1 ♀ in flower of *Clematis* sp. at 5700 ft., Oct. 1909 (*A. D. Imms*). Reg. 200 and 210.

*Thrips pallipes*, sp. n.

♀.—As in *Physothrips pallipes*, Bagn., but with a single-jointed antennal style.

*Hab.* JAPAN, Kobe (*Lewis*).

*Thrips immsi*, sp. n.

♀.—As in *Physothrips immsi*, sp. n., but with a single-joint antennal style, joints 6 and 7 measuring 38 and 12  $\mu$  respectively.

*Hab.* INDIA, Dehra Dun, 3 ♀ ♀ in flower of *Eriobotrya japonica*, Jan. 1, 1912; near Bhowali Kumaon, 1 ♀ with *P. immsi* m. in flower of *Clematis* sp. at 5700 ft. (*A. D. Imms*). Reg. 200 and 210.

*Thrips tabaci*, Lind.

*Hab.* AUSTRALIA, Coltsloe Beach near Fremantle, 1 ♀ in flower of *Acacia pulchella*, 31. viii. 1914; Mount Lotty Range, from flowers of *Acacia myrtifolia* and/or *Epachris impressa*, 9. viii. 1914 (*E. B. Poulton*). TASMANIA, Launceston, on rose, 28. iii. 14 (*R. Kelly*), females only. Reg. 40, 41, and 84.

All the above are referable to the dark variety, *pullus*.

*Thrips imaginis*, sp. n.

♀.—This species is almost identical with the last recorded species in its size, general form, and appearance, but may be at once separated by the presence of 4 or 5 pairs of small postero-marginal setæ between the postero-angular bristles instead of 3 larger pairs in *tabaci*; the absence of the comb (except at sides) of the eighth abdominal tergite and the presence of only 3 (1+1+1) setæ in the distal half of the upper vein of fore-wing. The relative lengths (and breadths) of antennal segments 3 to 7 are approximately as follows:—54 (18) : 46 (17) : 35 (17·5) : 46 (17) : 13  $\mu$ . Length (and breadth) of head and pronotum 90 (148) and 108 (172)  $\mu$  respectively, and length of pronotal postero-angular bristles 38  $\mu$ . Fore-wings with 28 to 32 and 18 setæ on the costa and lower vein respectively.

♂.—Pale yellow, basal antennal joints colourless, 2 and 3 pale tinged with grey, 4 tinged with grey to greyish-brown distally, and 5–7 yellowish-brown with 5 paler basally.

Abdominal tergite 9 with two long pairs of bristles on one plane and an outer shorter curved pair on a much higher plane.

The ♀ very often has the abdominal segments 9 and 10 noticeably darker than the rest of the abdomen and might with advantage be named var. *apicalis*, nov.

*Hab.* AUSTRALIA, Healesville, Victoria, both sexes on *Xanthorrhœa australis* and on roses, 12.x.1913, and on *Wahlenbergia gracilis*, 21.xii.1913 (*A. Eland Shaw*); ♀♀ only on *Acacia prominens*, 30.viii.14; on *Acacia decurrens*, var. *mollissima*, 30.x.15; on *Prostanthera lasiantha*, Mt. Yule, 18.xii.15. Ballarat, Victoria, on *Hypochaeris radicata*, 18.i.15 (*R. Kelly*). Adelaide, S. Australia, from flowers of *Acacia myrtifolia* and *Epachris impressa*, Mount Lofty Range, 9.viii.1914, and from *Mesembryanthemum*, Outer Harbour, 28.viii.1914 (*E. B. Poulton*).

*Thrips melanurus*, sp. n.

♀.—Length about 1·0 mm.

Colour pale greyish-yellow; wings, abdominal tergites 1–8 greyish, 9 brownish, and segment 10 strikingly blackish-brown. Antennæ with joints 1–3 pale, 4 brown with base and 5 with basal third to one-half pale, 6 and 7 entirely brown.



Head transverse, antennæ long and slender, of *T. flavus* type, and 2·5 times as long as the head; relative lengths (and breadths) of joints 2 to 7 approximately as follows:—

$$\mu 35 (22) : 52 (17) : 46 (17) : 36 (16) : 47 (16\cdot5) : 11 (6).$$

Pronotum 1·25 times the length of the head, bristles at posterior angles short, stout, and dark, about 0·4 the length of pronotum, a series of 3 pairs of postero-marginal setæ, of which the inmost is only slightly longer than the others and about 0·5 the length of the postero-angular bristles. Setæ of fore-wing, including costa, short and dark; costa with 24, lower vein 12–13 and upper vein with 4+3 at base of wing, 1+2 in the distal third. Apical abdominal bristles moderately long, those on segment 9 about 1·4 times as long and on 10 just as long as the segments bearing them. Tergite 8 fringed at the sides at least; it is impossible to say from the unique example if the fringe is broken medianly.

Length of head, pronotum, and wing 97, 122, and  $742\mu$ ; length of abdominal segments 8, 9, and 10, 60, 60, and  $68\mu$  respectively.

The specimen is unfortunately not only partially cleared, but to a large extent mounted sideways and therefore difficult to describe satisfactorily.

*Hab.* INDIA, Ringtong, T.E., Darjiling, 1 ♀ on rose, 4. vi. 1916 (*E. A. Andrews*).

*Thrips pusillus*, sp. n.

Length 0·8 mm.

Near *T. melanurus*, sp. n., with fore-wings, abdominal tergites, and segments 9 and 10 brown, antennal joints 4–7 brown and 1–3 pale, 1 being practically colourless.

Head transverse, about 0·6 as long as broad; eyes coarsely faceted, occupying about 0·65 the dorsal length of the head. Antennæ 2·5 times as long as the head, joints 3 and 4 fusiform; lengths (and breadths) of joints 2 to 7 approximately as follows:— $32 (22) : 41 (16) : 38 (16) : 30 (15) : 43 (15\cdot5) : 12\mu$ . Interocellar setæ situated one on each side of and on a line with the lower margin of the posterior ocellus, about 0·016 mm. long. Maxillary palpi 3-jointed, their lengths  $13 : 8$  and  $16\mu$  respectively.

Pronotum somewhat longer than the head and about 1·5 times as broad as long; inner postero-angular bristle longer than the outer (49 and  $54\mu$ ), and about 0·5 the median

length of pronotum, with a minute seta between them; postero-marginal setæ consisting of 3 pairs with the outer pair shortest and the inmost longest.

Costa of fore-wing with 18-20, lower vein with 11-12, and upper vein in the distal third with 1+1+1 setæ. Apical abdominal bristles of segments 9 and 10 not very long, longer than the segments bearing; tergite 8 irregularly fringed.

The specimens are cleared and, unfortunately, partially mounted sideways—they differ from *T. melanurus* in the small size, the less strikingly dark 10th abdominal segment, the relative lengths of the intermediate antennal segments, and the fewer wing-spines.

*Hab.* W. AFRICA, Gold Coast, Aburi, ♀ ♀ in flowers of *Strophanthus gratus* and *Canna*. Reg. 260, Nov. and Oct. 1915 respectively (*W. H. Patterson*).

*Isoneurothrips australis*, Bagn.

Females only.

*Hab.* AUSTRALIA, Healesville, Victoria, on *Laurestina*; numerous, and Lake Endonia, on dahlia (*ex hortis*), 22. Lake Endonia, ii. 1919 (*R. Kelly*); Launceston, Tasmania, on rose, 28. iii. 1914 (*R. Kelly*); Coltsloe Beach, near Fremantle, W. Australia, from the white flower of a *Proteaceus* shrub (*Dryandra floribunda*, R. Br.), and also from mixed flowers, 31. viii. 1914 (*E. B. Poulton*).

Genus MICROCEPHALOTHRIPS, nov.

♀.—Head smaller (both shorter and markedly narrower) than the pronotum, transverse. Maxillary palpi 3-segmented and antennæ 7-segmented as in *Thrips*. Pronotum large, posterior margin with at least eight pairs of small setæ, two at each hind angle being but slightly larger than the others.

Posterior margins of the abdominal tergites 1 to 8 serrate, the teeth of the eighth tergite being produced to hair-like points, forming the "comb" peculiar to this segment. Bristles of segments 9 and 10 normal, without the heavy spine-like bristles described in *Idolimoethrips*, Priesner. Abdominal and wing setæ sparse and minute.

Type. *Microcephalothrips (Thrips) abdominalis* (Crawford).

*Microcephalothrips abdominalis* (Crawf.).

= *Thrips abdominalis*, Crawford, 1910, Pomona Journ. Ent. ii. p. 157.

The generic characters enumerated above are clearly shown in Crawford's figures, his species having no likeness or relationship to *Thrips albopilosus*, Uz., with which he compares it. Previously known from several North American States, Cuba, and Mexico, chiefly from the flower-heads of various Compositæ.

*Hab.* FIJI, Lautoka, ♀ ♀ in flowers of *Tridax procumbens*, 6.i. 1923 (*W. Greenwood*), I.B.E. Lg. 298.

The recently described *Thrips microcephalis* of Priesner would also appear to fall in this genus.

### XIII.—*The Mating Habits of British Thomisid and Sparassid Spiders.* By W. S. BRISTOWE, B.A.

A SMALL paper, entitled "A Theory of Animal Courtship," appeared in the Ann. & Mag. Nat. Hist. in November 1925, in which the author, Mr. T. H. Savory, sets out to explain the value, meaning, and inner significance of animal courtship by means of his interpretation of the courtship phenomena of spiders. Apart from the danger of sweeping generalizations, even his theories to explain the courtship of spiders appear to be based almost entirely on the observations of a few other workers. yet, in spite of this, his explanation is probably not very far from the true one. Mr. Savory concludes that the male courtship in spiders (and all animals) has as its function a sensuous appeal to the female which induces physical preparation for the subsequent union. This very same idea had previously been advanced by Prof. J. S. Huxley (10\*) for birds. Huxley has pointed out that most birds are monogamous; that in these forms the display does not occur until after pairing up has taken place; that the function of the display is chiefly one of stimulation. I, working quite independently (2), realized the importance of stimulation in the case of spider courtship, but also recognized another very important function of courtship in that group—namely, recognition. In the short-sighted wandering spiders the males lift their legs and grope their way as they walk, often touching the female with their sense-tipped legs before they see her. In longer-sighted forms the females would leap upon the males and kill them before this could occur. If the legs, which these males were in the custom of raising, were decorated conspicuously, the females would be more likely to distinguish

\* Numbers refer to the List of Literature at the end of the paper.

them from other spiders as they approached, and less likely to treat them as something to be eaten. This I believe to have been the origin of the complicated courting performances of the long-sighted *ATTIDÆ* and *LYCOSIDÆ*. The Lycosid eyesight is not so developed as that of the *ATTIDÆ*, and, having discovered by their sense of smell that a female is in the neighbourhood \*, they commence their antics. The Attid males, though excited by the scent of the female, trust to their eyesight before displaying their distinctive epigamic characters. Having commenced his courtship, the male spider is relatively safe, and it is probably very exceptional for the female to kill the male †, but it takes a variable amount of importunity on his part to stimulate her to such a degree that she will submit herself to him. *Recognition and stimulation* are both necessary before copulation can take place. The males possessing the most effective epigamic characters and display will, in the first place, be most easily distinguished (and therefore less likely to be killed), and, in the second place, effect the necessary stimulation more rapidly. Sexual selection should operate along both these lines to produce males with distinctive displays and, in the longer-sighted forms, such as the Lycosids and Attids, with conspicuous epigamic ornamentations. In the web-building forms the female is able to recognize the male's presence in her web by his distinctive tweaks and vibrations of the threads, but it requires a varying amount of importunity on his part to gain her submission. The harmony with which the sexes live together varies considerably with different species, but in many cases a few tweaks of the web in his own peculiar code immediately allays any suspicion that there is an insect in the web which must be dealt with. Some species appear to live in apparent harmony together for considerable periods. The males lurk in the outskirts of the web, and, if his wanderings attract the attention of the female, she returns to her retreat on receipt of his telegraphic signal. In the paper already cited I have shown that in a few cases where long-sighted females did not recognize the males † the latter were killed. Thus, to repeat what I have said above, the courtship of spiders is, firstly, to gain recognition and, secondly, to excite the female to a state at which she will submit to copulation. A discussion of the earlier theories to explain the courtship of spiders formulated by Darwin, Wallace, Montgomery, Berland, etc., is dealt with in my earlier paper (2).

\* The proof that male spiders can recognize the presence of a female by touching the ground over which she has passed with the tips of their legs and palpi is clearly set forth in a recent paper published by myself in conjunction with Mr. G. H. Locket (2).

† Soon after copulation had taken place a male *Tarentula barbipes* was killed. He was not displaying his epigamic characters in the manner usual for a male in the presence of a female. Another male of the same species whose eyes were covered and whose scent-organs had been removed, did not perform his customary display. He also was killed (2). It seems probable that male spiders are not infrequently killed by the females shortly after copulation has taken place—a time at which the sexual instincts of both sexes is at a minimum.

I have now finished all I intend to say on Mr. Savory's theory of animal courtship, and I will pass on to two paragraphs in his paper with which I find myself in complete disagreement and which really prompted me to write the present paper:—

“But there is at least one other large family of keen-eyed hunting spiders—the crab-spiders, or THOMISIDÆ. The members of this family rely on sight to warn them, as they lurk in flowers or under fallen leaves, of the approach of possible prey. And it cannot be too strongly emphasized that in this family sexual dimorphism is frequently conspicuous. One has but to refer to the extreme instance of *Philodromus dispar*, Walck., as a ready example. It is true that as yet no observer has described any act of courtship as occurring among the THOMISIDÆ, but I believe that such may be found; nay, more, I will go further and say that, from certain tentative, and as yet unconfirmed, observations of my own, I am almost certain that, by some species at least, courtship is undertaken.”

“So also may one prophesy that visual courtship occurs in the family SPARASSIDÆ, of whose British representative, *Micrommata virescens*, Clerck, the male is a vivid and beautiful creature.”

In the first place, even viewed from the short-sighted standpoint of spiders, the Crab-spiders cannot be said to have particularly acute eyesight. The mode of capturing prey adopted by *Xysticus* and *Misumena* is to sit absolutely still in some suitable spot with outstretched legs awaiting the approach of an insect, and, when one comes within “arm's length,” it is seized in the spider's powerful embrace. True, they may sometimes be seen slightly rotating their bodies in order to face an insect hovering round an inch or two away, but this is a moving object and the image may be a blurred one. It is true that some Crab-spiders are more active in their pursuit of prey, but, for that matter, I have seen both the Epeirid spiders, *Tetragnatha solandrii* and *Meta segmentata* \*, drop an inch or two from their webs and seize a passing insect in their jaws. The size of the eyes in the THOMISIDÆ does not point towards their possessing long sight and nor do observations on their habits.

Secondly, marked sexual dimorphism is the exception rather than the rule, and, where it does occur, some explanation other than sexual selection is in all probability necessary. The majority of Crab-spiders are slim editions of the females with somewhat darker markings. In some cases it might even be suggested that the darker coloration of the male is due to that sex possessing the same amount of pigment distributed over a smaller area. The abdomens of females after egg-laying shrink to about half their previous size, and, in so doing, their coloration approximates much more closely to that of the males. It may be taken as a general rule that in all spiders, no matter how defective their sight may be, the

\* In ‘The Spiders of Dorset’ the late Rev. O. P. Cambridge also records having seen this species drop from its web to catch a passing insect.

males are slimmer and darker than their females. Many marked cases of sexual dimorphism occur amongst the short-sighted Argiopidae, and where this difference in the sexes is used by the male during courtship these modifications are usually restricted to a certain part of their body which is conspicuously displayed.

Lastly, we come to the prophecies of courtship in the families THOMISIDÆ and SPARASSIDÆ. The careful observations of Montgomery (13, 14, 15), Gerhardt (5, 6, 7), and other workers forced them to the conclusion that visual courtship in these families does not occur, and my own observations, which I give below, go far to bear out their conclusion. Montgomery, in speaking of *Xysticus stomachosus*, Keys. (13), an American species, says: "There is no courtship on the part of the male nor any instigation by the female. When the male is first put in the cage of a female, even though he faces her, he does not seem to recognize her as such by sight, and pays no attention to her until he touches her, when he quickly gets upon her back." In *X. stomachosus* the male immediately "seized the feet of her right fore-legs with his right fore-legs, and holding them thus (only the metatarsi in contact) he quickly revolved around her and climbed upon her back from behind. She immediately became immobile with her legs flexed close to her body." In another American species, *X. nervosus*, Banks, the males embraced the females without any preliminary courtship. Gerhardt, working in the neighbourhood of Breslau, that not only *Xysticus cristatus*, Clerck (*viaticus*), but also *Philodromus dispar*, Walck (the species noted by Savory as possessing marked sexual dimorphism), and *Philodromus aureolus*, Clerck, on approaching the females immediately caught hold of their legs with their own and mounted on top of them from behind, while the tiny male of *Misumena vatia*, Clerck, walked straight on top of the relatively enormous female. In *Micrommata virescens*, Clerck, the handsome male leapt upon the female without any form of display being resorted to.

Before I treat my observations in detail, I will give an outline with the conclusions I have drawn from them. In the species I have observed the male without any preliminary courtship either mounts straightway on to the female's back (*Misumena* and *Diæa*), or, especially if she tries to escape, roughly seizes one of her legs (*Xysticus*, *Tibellus*), or even some part of her body (*Micrommata*) in his jaws. Being rather short-sighted and slow-moving creatures, taken as a whole, the loss of an opportunity by a male Crab-spider may result in his not coming in contact with another female for a considerable period, so, once found, a female must not be allowed to escape if possible. Although no preliminary courtship takes place in the ordinary way, recognition by sight as well as by smell does seem to occur, for it was noticed in the case of *Xysticus* that when a male approached a female which was no longer desirous of copulation, the female took up a menacing attitude which had the effect of frightening him away. On these occasions he himself sometimes waved his legs about,

which may perhaps be taken as a primitive form of courtship (or possibly as counter-menaces), but he did not dare to approach too closely, and ended by slinking away. After mounting the females' backs the male Crab-spiders usually walk about over them and tickle the females with the tips of their legs; this probably has the necessary stimulating effect on the female. Without her help the male appears to have difficulty in raising her abdomen (see *Xysticus* observation for April 14th, 1921). As they walk about these species trail a thread, which in the ordinary way saves them from falling from the plants, etc., up which they climb. This habit was probably the origin of a very interesting phenomenon which occurs in the case of *Xysticus cristatus*—after mounting the female, the male proceeds to fasten her down with threads stretched from her legs and body to the ground before copulation takes place. I briefly recorded this observation in 1922 (1), and since that date Gerhardt has independently noted the same phenomenon both in the present species and also in *X. lanio* (6). This interesting *Xysticus* habit has no recorded parallel, but some observations I have made on the Epeirid spider, *Meta segmentata*, appear to be somewhat similar in some respects. In this species the males sit at the outskirts of the females' webs. When an insect is caught in the web, the female rushes forth to catch it and wraps it up in web according to the Epeirid custom. The male then advances, gently shaking the web, and, when in reach of the female, which is by this time feeding on the insect, he tickles her with his long front legs. At first she may resent his attentions and chase him away, but eventually she takes no notice, and he walks over her, tickling her as he goes. After he has passed over her he fastens the thread he has been trailing to a strand of the web, turns round, and again walks over her as before. I have seen males doing this over and over again without disturbing the female, who is busy eating the insect she has caught, until she is covered in silk trailed by the male. After a time he stops beside her and at first gently and then more rapidly begins to wrap her up with silk after the fashion of Epeirid spiders with their prey. On each of the occasions that I have witnessed the above proceeding, the female has become aroused and, sometimes with a certain amount of difficulty, has torn herself free. The only occasion on which I have observed copulation in the species, it did not follow this kind of behaviour on the part of the male, and whether it ever does I cannot at present say. If it does, it becomes interesting to compare the mating habits of this species, on the one hand, with *Xysticus cristatus*, where the female is fastened down before copulation takes place, and, on the other, with *Pisaura mirabilis*, where the male presents a fly to the female before attempting to copulate with her (2).

The mode of copulation appears to be remarkably constant for each genus. The position taken up, as Gerhardt has suggested (6), probably is dependent on the shape of the spider's body in each case. Those with fairly normal or elongate sort of bodies (*Micrommata*, *Tibellus*) lean over the side of the female with

their heads facing in the opposite direction to that of the females in the manner taken up by *Lycosa*, *Agelena*, etc. Those in which the bodies are shorter and more squat (*Philodromus*, *Diæa*) take up rather the same position, but, owing to the shortness of their reach, it is necessary for the males to reach further over until their bodies are almost vertical. In *Xysticus* where the abbreviation of the abdomen is particularly marked, the male reaches round from the posterior end of the female's abdomen. In *Misumena* it is necessary for the male to climb right underneath the female.

The method of palpal insertion has been fairly constant for the different genera as far as observations go at present. In the genera *Xysticus* and *Micrommata* the palps are inserted one at a time for fairly long periods, while in *Tibellus*, *Philodromus*, and *Diæa* the insertions are short, and in *Misumena* both palps are inserted simultaneously. The insertion of both palps at once has been shown to occur in some other spiders—notably, those belonging to the sub-section Haplogynæ\*; but, in addition to the various families in which it appears to be a constant feature, there are various isolated species belonging to other families in which it also occurs (*Misumena* being an example). No explanation of this method of copulation has been found, but it seems necessary that certain physical conditions should be fulfilled for the simultaneous insertion of the palps to be possible—the male palps must not be too large and the female vulva not too narrow. Further, it seems necessary that the sexes should either be facing in exactly similar (*Misumena*) or in exactly opposite directions (*Scytodes*, *Harpactes*, etc.)—or, to make my meaning more accurate and clear, that a line drawn from the centre of the caput of each individual to the centre of the posterior portion of their abdomens, when viewed dorsally, should meet and form one straight line.

Observations have been made on the following species, and these I will deal with in turn:—

#### Thomisidæ.

*Xysticus cristatus*, Clerck.

*Misumena vatia*, Clerck.

*Diæa dorsata*, Fabr.

*Tibellus maritimus*, Camb.

#### Sparassidæ.

*Micrommata virescens*, Clerck.

\* None of the OONOPIDÆ have been seen in copulation, but since this family is included in the Haplogynæ they might also be expected to indulge in simultaneous insertion, and from my own scanty experience of their mating habits I believe this to be the case. On Dec. 6th, 1923, a male and female *Oonops domesticus*, Dahl, were placed together. They met. He stroked her legs. She advanced, and he, still stroking her legs and with snapping falcæ, crept under her, and, as far as I could see, inserted both palps immediately. In attempting to get a closer view I disturbed them. Further opportunities of capturing a ♂ and ♀ *Oonops* at the same time have been denied me. I recorded the occurrence of *Oonops domesticus* in G. B. for the first time in 1922.



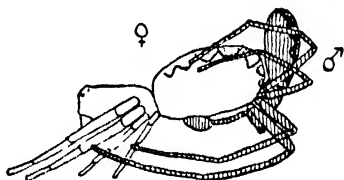
*Xysticus cristatus*, Clerck.

(=*Thomisus cristatus* in Blackwall's 'Spiders of G. B. and Ire.')

This is probably the commonest British Crab-spider. It is to be found in all manner of situations—amongst moss, under stones, in flowers, and amongst the foliage of shrubs and trees. The female is rather sedentary in habits, and waits in suitable situations until insects approach within the reach of her outstretched front legs, when, like a flash, they were seized in her powerful embrace. The male, which is smaller and considerably darker in colour, on reaching maturity leads a wandering life, and is often to be met with running somewhat awkwardly across the ground searching for a mate.

On April 10th, 1921, I placed a male and a female *X. cristatus*, which I had caught on the previous day, in a box together, and mating occurred without any preliminary courtship on the part of the male having been noted. He turned round on top of her several times and then tried to lift her abdomen to allow him to reach her vulva with his palp. First he tried behind, standing almost vertically on his head and bending his legs under her body,

Fig. 1.



Copulation of ♂ (shaded) and ♀ *Xysticus cristatus*, Clerck.

then he edged round to the sides, and finally managed to do so, after he had returned to the first position to her rear. Copulation lasted about  $1\frac{1}{2}$  hours.

On April 14th, 1921, a female which I had been keeping in captivity for a short time performed her final moult. A male was introduced into her box. On finding her, he seized one of her legs in his jaws and, after the slight resistance she put up had subsided, he crept up behind her and mounted on to her back. Here he turned round several times, and then standing vertically upside down with his head on the ground, attempted to lift up her abdomen. His first efforts were made from behind, and from this position he edged round first to one side and then to the other, but without success. He returned to his place on top of her and turned round, as he had previously done, and then renewed his attempts to raise her body, which were this time successful. Copulation started at 7.10 and ended some time between 8 and 9 o'clock.

A male and female, which had mated together three times

previously, were put together on May 11th, 1921, and presently they came face to face. The female waved her front legs, slightly quivering, and the male advanced, behaving in a similar fashion. She retreated and he gave chase quite fiercely, but she managed to escape. He felt the ground excitedly with the tips of his legs, in an attempt to track her down by means of his scent-organs. Presently they again faced one another and the same actions took place, but this time he rushed at her and caught one of her front legs in his jaws. They rolled over and over, but he kept a firm grip of her leg, and, when she had ceased struggling, he climbed on to her back from behind. Having reached this position he proceeded to turn round as on previous occasions, and close inspection showed that in doing this he was methodically fastening her down to the ground with silk\*. First a thread was attached to the ground and then to one of her legs or some part of her body, until finally she was securely tied down. His next move, as on the previous occasions recorded, was to raise her abdomen from behind and insert a palp. During the various processes connected with mating an occasional twitch of the male's abdomen was noticed, and another interesting phenomenon—a movement of the leg-spines—was also observed. This movement of spines during copulation had not previously been recorded, and a more detailed account of the phenomenon is given amongst my observations later on in the present paper in dealing with *Micrommata virescens*. Copulation started at 2.3. At 3.9 he paused for about half a minute and then resumed his activities till 3.11. At 3.11 he again stopped, this time for nearly a minute, and finally left her at 3.13. The female remained motionless where he had left her until 3.18, when she began to move about, and considerable difficulty was experienced in disentangling her legs from the web he had spun over them.

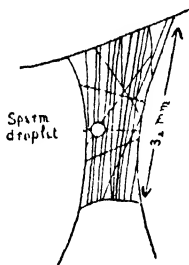
In the evening the male was observed transferring his sperms from his abdomen to his palps. At 7.45 my attention was drawn to him by the queer manner in which he was waving his palps about in the air. Occasionally he paused to chew one of them with his falcies. Under a lens I could see that he had spun a few threads, and at intervals he stopped waving his palps to spin another thread about 4 mm. in length across a little oblong frame, tilted slightly downwards and sideways, and formed by four intersecting threads of thickish silk. This proceeding, of alternately waving his palps about and then pausing to stretch one and sometimes two fine threads across this little frame, continued until,

\* This is recorded by Gerhardt as a new observation in 1924 (6). I, however, had noticed it a few years previously, and in 1922 (1) wrote as follows:—"In one species, at any rate (*Xysticus cristatus*), the male actually ties her to the ground with silken threads before mating with her. I hope soon to publish a paper dealing with this subject; but I might mention here, without attempting to explain it, a queer movement of the leg-spines—when the palpal bulb is expanded, these stand out at right angles to the leg, returning to their normal position along it on the collapse of the bulb."

finally, the whole frame had been completely filled in with threads. Presently he pressed his abdomen up against the underside of the web and a tiny white droplet was secreted on it. Then for about twenty minutes the spider alternately placed each palp on the upper surface of the web and absorbed the sperms through it, each palp being applied about 25 times.

The same male and female were placed together on May 14th. He approached her, waving his legs, and she fled, but eventually, after a struggle, he caught her by one of her front legs, and then slowly crept on top of her. As before he fastened her down before copulating with her. Copulation lasted  $1\frac{1}{2}$  hours, and on the following morning a sperm-transference web, very similar to the previous one, was discovered in his box. On the following day they were again put in the same box. The female seemed unwilling to copulate and raised her front legs threateningly, giving a little jerk forwards every few seconds whenever he approached. Although the male appeared to be quite ardent, he seemed to recognise this as a danger signal and retreated. I have

Fig. 2.



Web built by ♂ *Xysticus cristatus* for sperm-transference.

noted a similar occurrence on other occasions; thus, on May 29th, whenever a male and female which I had placed together came face to face, the female raised her legs and every one or two seconds gave a little jerk of the body and legs. When she stopped, the male waved his legs up and down, but each time he approached she repeated her actions and he retreated. This went on for some time, and finally he walked away. On May 14th, 1922, a male was placed in a box with a female with which another male had finished copulation a short time previously. On the approach of this second male the female raised her legs and vibrated or jerked them, and he ran away as though he were frightened.

Thus, in this species there does seem to be some slight visual communication between the sexes. In the early part of the mating period the male rushes at the female without any previous courtship, but later on, when she no longer feels a desire for copulation, she takes up an attitude which he apparently recognises as a warning to keep out of her way. For a time he may perform

a crude form of courtship (*vide* my observations of May 29th, 1921), but that he can recognise her danger-signal seems certain. This attitude which the female takes up on these occasions—legs outstretched and a jerk of the body and legs every few seconds—is also adopted when she is guarding her eggs and some creature too formidable to kill approaches. It will probably be found that other female Thomisids which no longer wish to copulate take up this attitude on the approach of a male.

On May 14th, 1922, a male and female *Xysticus cristatus* were found in copulation on the side of an old brick, and, as I have found to be the case in captivity, the female was fastened down with threads spun by the male.

Males of this species, when placed in boxes previously occupied by females, feel the ground excitedly with the tips of their legs and palpi, thereby showing that they can detect the scent of the female, as Mr. Locket and I have shown to be the case in other families (2).

### *Diæa dorsata*, Fabr.

(= *Thomisus floricolens*, in Blackwall's 'Spiders of G. B. & Ire.')

This striking little species has bright green legs and cephalothorax with a white abdomen, marked above with a light brown leaf-shaped pattern. They hibernate under bark, etc., in various stages of growth, and during the warmer months lurk amongst the leaves of trees and shrubs. It is not until beating is resorted to that one realises how common they really are. When very young the spiders' abdomens are almost white and their legs are only faintly greenish; gradually the mature tints appear, but the sexes cannot easily be distinguished until they are almost full grown, by which time the male has become somewhat slimmer and longer in the leg. When kept in captivity in cylindrical glass-topped boxes this species has the strange habit of making quite a substantial pillar-shaped web. This appears to have no apparent function as a snare, but, as no other Thomisid, to my knowledge, does likewise, it is perhaps worth recording. In nature it is a fairly restless species, and in its wanderings amongst the foliage a line is always trailed behind it. On April 12th, 1920, some adult males, and some females requiring one more moult before reaching maturity, were collected at Box Hill, Surrey. (They were abundant in all stages of growth amongst the box and yew foliage.) A male was placed in a box with one of these females, and, after facing one another for a short time, the female gently but firmly pushed him away with her front legs\*. On May 2nd, after having refused food for several days, one of the females moulted, and on the following day a male was placed in her box. He seemed to become aware of her presence immediately and, after carefully feeling the ground with his palps and the tip of his

\* A similar observation was made by Montgomery on *Xysticus nervosus*, Banks (14).

legs, he began walking about, twitching his abdomen up and down every second or two as he went. When he eventually came in her direction he stopped in front of her, and then fearlessly strode over her and seated himself on the top of her. She made no resistance whatever either on this occasion or on subsequent occasions on which mating was observed. He next proceeded to lean over one side of her, gently tickling her with his legs and rolling her slightly to one side so as to enable him to insert one of his palps. At intervals he changed from one side to the other, and finally left her after copulation had been going on for about five minutes. Later observations all agreed very closely with those given above. In one case copulation took place between the same two individuals twice in one day. On one occasion a male was put in a box with a female which had moulted a short time previously. As usual, he set out with a show of considerable excitement to find her, and in his wanderings came across the cast-off skin of the female. This he embraced with avidity, and he explored it most carefully, walking round and round it many times, before finally leaving it\*. On June 24th the female, which moulted on May 2nd and mated for the first time on May 3rd, laid a round bundle of yellow eggs in the upper corner of the box in which she was confined. The eggs were surrounded by a closely-woven layer of white silk with an outer shiny and waterproof layer. From this date until the later days of July, when the young ones began to hatch out, she sat on her egg-cocoon, catching any small insects which came her way, and biting fiercely at larger intruders in an attempt to drive them away. On these occasions, when a large creature came her way, she sat up with front legs outstretched and gave occasional jerks with her body. This appears to be a warning signal, and in another Thomisid, about which we have already spoken in this paper, *Xysticus cristatus*, the male ceases his overtures if the female behaves in this manner.

*Tibellus maritimus*, Menge.

This is a rare spider closely resembling its more common relative *T. oblongus*, Walck., with which it is probably often confused. They are hay-coloured elongate spiders which run rapidly up the stems of grass and herbage, being often hard to see amongst the hay-coloured grass, of which they seem to be particularly fond for a hunting-ground. The sexes vary but little in general appearance, the males being slightly slimmer and darker in colour. Both species of this genus are frequently to be found at Wicken Fen,

\* F. M. Campbell, in his paper in the Journ. Linn. Soc. vol. xvii. 1883, on the mating habits of *T. parietina*, Fourcr. (= *T. guyonii*, Guér.), describes rather a similar incident. In cases like this it appears to be the spider's sense of smell which leads him astray. One touch of the cast skin convinces him that the female is there, and I have seen males becoming almost equally excited on coming in contact with the mangled remains of an insect the female has been eating.

Cambridgeshire, and on May 27th I put a male and female *T. maritimus*, which I had captured in that locality a few days previously, together in the same box. No preliminary courtship took place. On approaching one another the male rushed at the female and tried to catch her, but she managed to escape. On the second occasion she made no resistance and he walked on top of her tickling her with his legs. In all probability these tickling movements have an exciting effect, for they are a very common occurrence and have been noticed in many species. His next action was to catch one of her second pair of legs in his jaws in an attempt to pull her on to her side. In this he did not succeed, so he tried gripping one of the third pair. This also failed. Finally, by dint of considerable tugging with one of her fourth legs gripped firmly in his jaws, he succeeded in pulling her on to her left side. This accomplished, he gently stroked her vulva and then inserted a palp. The first insertion took place at 12.15½. At 12.29 he turned her on to her other side and inserted his other palp. Further changes were made at 12.34½, 12.42, and 12.48¾, shortly after which he left her. The total time taken was thus about 33½ minutes. No movement of the spines on his legs was noticed, and he did not tie the female down with silk as in the case of *Xysticus cristatus*.

On June 1st I put another male and female *T. maritimus* together. The male immediately seized the female by one of her second legs in his jaw. She immediately became quiet, though at the time of being caught she was attempting to run away. Holding firmly on to this leg, he dragged her to a suitable place and then pulled her on to her left side. Copulation started at 4.52½ and he left her at 5.17, after changing sides at the following times: 4.54, 4.56, 5.1, and 5.6½.

#### *Misumena vatia*, Clerck.

(= *Thomisus citreus* in Blackwall's 'Spiders of G. B. & Ire.')

This is a common spider, to be found, as a rule, in yellow or white flowers, where it lurks in wait for insects. The female is a plump spider of somewhat variable colour, ranging between greenish white to bright yellow and sometimes possessing chocolate-brown splotches on her flanks. The male is very diminutive and is darker in colour, usually greenish and black.

A male was placed in the company of a female on June 24th, 1921. He appeared to detect her presence before he knew in which direction she lay, for he felt the ground excitedly with his palps and legs and walked about waving his legs and giving an occasional twitch with his abdomen. On discovering her, he climbed up her body from behind without any preliminary courtship and clasped her comparatively enormous abdomen. She took no notice of him whatsoever. After turning round rapidly on top of her several times, he crept under her abdomen, which she seemed to hold up for his benefit, but after 3 minutes he climbed to the upper side again and presently left her.

*Micrommata virescens*, Clerck.

(= *Sparassus smaragdulus* in Blackwall's 'Spiders of G. B. & Ire.')

With the possible exception of the exceedingly rare crimson and black *Eresus cinnabarinus*, Oliv., this is certainly the most handsome British spider. Considerable sexual dimorphism occurs. The female is grass-green, the male a similar colour with bands of bright red and yellow on the upper sides of his abdomen, but, judging by the fact that the male adornments are not restricted in any way to the parts of the body most visible to the female, by the lack of courting ceremonies, and by the fact that one male which had not had time to develop his yellow and red markings after his final moult succeeded in reducing a female to submission, it seems unlikely that the bright colours of the male have any connection with questions of courtship. What the explanation may be seems uncertain, but, if pressed for my explanation of the darker colours prevailing amongst spiders in general, I would suggest that in some cases a similar amount of pigment exists in the two sexes, but that this pigment is more concentrated in the male owing to his smaller size. At egg-laying a female sometimes seems to shrink to about one-half her previous size and the darkening in shade is quite marked. Up till the last moult very often there is but little difference between the two sexes (in *Micrommata* he begins to develop his red stripes a week or two before the last moult), and, though I have taken no measurements, the male sometimes looks larger before the final moult than after it, while the reverse is the case with the female. Perhaps extra pigment is produced at the expense of further growth in size; possibly the extra development of pigment depletes his stock of energy and this may be one of the causes of short life in the male spiders. A statistical investigation of the length of life in the males of different species would be well worth carrying out, for, from general observation, I should feel inclined to say that the males have shorter lives in families where the extra pigmentation of the males is marked (ATTIDÆ) than in families where the sexes resemble one another more closely (AGELENIDÆ, DICTYNIDÆ, etc.). Similarly, that within the same family the males have shorter lives in those species in which they are particularly well provided with pigment—for example, in the family ATTIDÆ, I should tentatively suggest that the male *Ælurillus v-insignitus* probably had a shorter existence than the male *Marpessa muscosa* or *Sitticus pubescens*. This suggestion may be entirely fallacious. It may not require very much energy to form the extra pigment possessed by so many male spiders, and that it might even be shown that the apparent longevity of the males in some species was due merely to the individual males becoming mature at different periods of the season, and therefore likely to be met with over a longer period.

*Micrommata* is not a common species, but it usually restricts itself to open spaces in woods away from habitations, and, in

addition, it is often very difficult to see amongst the grass where it occurs. At the beginning of June 1921, several mature males and females were collected near Wellington College, Berkshire. That the males could recognize the females by smell was indicated by the excited manner in which they walked about, feeling the ground with the tips of their legs and palps, when placed in a box which had previously contained a female. On June 10th a male was placed in a large case with a female and he immediately leapt upon her. She made no resistance, but he scrambled on top of her and held the front part of her abdomen in his jaws, piercing the skin in doing so. Presently he released his grip and walked about over her trailing a thread, but not fastening her down as in *Xysticus*. Occasionally his abdomen moved up and down. Eventually he leant over one side and tilted her abdomen on to its right side; then, after stroking her vulva with his palps for a short time, his left palp was inserted. Copulation started at 2.43 and at 5.48 he turned her on to her other side and inserted his right palp. At 8.47 he removed this palp and with a leap jumped away from her.

On another occasion (June 13) the male rushed at the female when they were placed together and seized her by a leg. She made no resistance, so he clambered on top of her, and, after tickling her slightly with his legs, leant over one side and turned her abdomen slightly on its left side to enable him to insert his palp. Copulation lasted 7 hours 37 mins.

On June 8th one of the males I was keeping in captivity moulted. Before the moult he had started to develop his red bands, but after the moult no signs of these ornamentations were present and a few days elapsed, under the shady conditions in which he was kept in captivity, before they had reached their ultimate shade. On June 13th, whilst still of a green coloration, he was placed in a glass case with a female. He rushed at her, and in the short struggle which ensued seized the tip of her abdomen in his jaws. When her struggles ceased, he loosed his grip and I could distinctly see a drop of her blood at the spot where his jaws had pierced her skin. He mounted her body, and leaning over one side stroked her vulva with his palp, as I observed the other males do. This continued for some time, and then he leant over the other side and stroked her vulva with his other palp, but no copulation took place. I soon realized that he was having some difficulty in inserting his palp, so watched the proceeding under a powerful lens and found that during this process of stroking he was trying to insert the sharp process situated on the last joint but one of his palp; the tibial spur, in one or two small grooves situated at the posterior end of the epigynal plate. Having got it fixed, the palpal bulb (*hæmatodocha*) began to swell out preparatory to a discharge of spermatozoa, but the pressure exerted by this was so great that this spur which held the palp in position bent and came unfixed once more. His cuticle had not had time to harden after his moult. Eventually, however, after a great number of fruitless



attempts lasting nearly an hour, he succeeded in inserting one of his palps and copulation took place. The function and importance of these tibial spurs in male spiders does not seem to be widely recognized (see, however, A. Karspinski, Biol. Zentralbl. vol. i. 1882, and U. Gerhardt, 7). These spurs are of great systematic value and sometimes they afford the only ready means of distinguishing between closely allied species. It certainly seems as though this should form a check against allied species breeding with one another, should they attempt to do so. By June 1915 this male had developed all his bright colours, and the insertion of his palps took place without any delay.

On June 24th a male and female which had been placed together rushed at one another. The male received a bite in one of

Fig. 3.

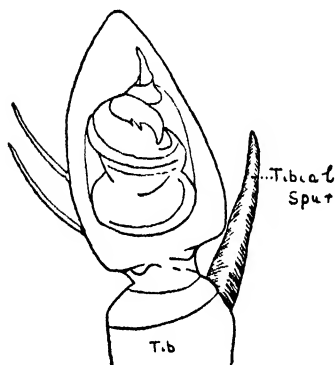
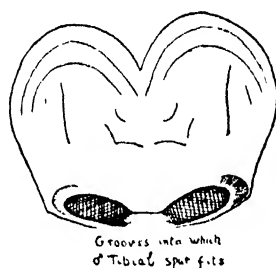


Fig. 4.



*Micrommata virescens*, Clerck.

Fig. 3.—♂ palp to show tibial spur.

Fig. 4.—♀ vulva to show the grooves into which the ♂ tibial spurs fit before copulation can take place.

his legs, but he seized her abdomen in his jaws and later mounted her back.

During copulation the spines of this species were seen to move, as had been noticed earlier in the case of *X. cristatus* (1), and later in the case of some spiders belonging to other families. Every time the palp swelled, which happened regularly about every 24 seconds, the spines on the male's legs were seen to move out almost at right angles to the leg with a jerk, and then, when the spermatozoa were discharged and the bulb collapsed, they returned at intervals, but in a regular order, to their former positions. Some returned to their former positions immediately, others later, one by one, while some did not move at all, but after every collapse of the bulb they moved in the same order. As an example, the

patella and tibia of a male's back leg were watched and the order of their returning to their normal positions is shown in the diagram by numbers. Number 1 was followed directly by 2. Number 3 started almost simultaneously with 2, but its movement was much slower. Number 4 was very slow. That these spines in the legs of spiders are movable has been known for a long time, their function being thought to be protective, but that they move during copulation had not previously been noticed. That they should move at such a time is probably only accidental and dependent on the great effort exerted by the spider in discharging the spermatozoa. The exact method by which the spermatozoa are discharged is still a matter of discussion, but this spine-movement goes to

Fig. 5.

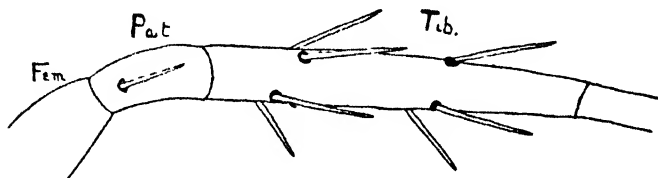
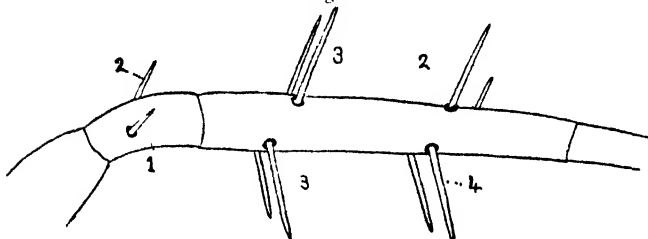


Fig. 6.



*Micrommata virescens*, Clerck.

Fig. 5.—Part of right hind leg of ♂, showing spines in normal position.

Fem.=femur; Pat.=patella; Tib.=tibia.

Fig. 6.—Position taken by spines on the swelling of the hæmatodocha.

The numbers indicate order of return to normal position.

show that whatever pressure is exerted to bring it about is not confined to the pulps alone but to the whole body. My view is that great pressure of the body-fluid is set up by muscular contraction, and the pressure thus formed forces out the spermatozoa \* in a fashion analagous to the dispersion of spores by the fungal mould *Mucor*. There the pressure is exerted on the thin wall separating the "stalk" from the "sporangium head," and this pressure eventually bursts the sporangium and liberates the spores. In that case the pressure is due to turgescence. The discharge of

\* This theory was brought forward by P. Bertkau in 1878 (Verhandl. d. nat. Ver. Rheinland-Westf. vol. xxxv.).

spermatozoa from the spider's palp is also, I believe, caused by turgescence set up by contraction of the muscular system. Not only does a stream of the body-fluid pass along the palpi, but also along the legs, and a stiffening of the legs is always to be seen at the time the hæmatodocha is expanding, prior to a discharge of spermatozoa. Whether the erection of the spines is caused directly by the pressure of the body-fluid or by contraction of the muscles situated at the base of these spines (in conjunction with the contraction of the body-muscles which are causing the turgescence) I am unable to say. I am inclined to favour the former view\* in company with Gerhardt (7), whom I told of my observation and who has since observed the phenomenon in the Attids *Evarcha falcata* and *Heliophanus cupreus* in addition to *Micrommata virescens*. I have noted the erection of spines in *M. virescens*, *X. cristatus*, *Harpactes hombergii*, and *Heliophanus flavipes*. At present it does not seem possible to make any generalizations on the occurrence in certain families, or even genera, for Gerhardt states that the phenomenon does not take place in *Xysticus lanio*, *Segestria*, *Dysdera*, or *Hoplopholcus*, while I have failed to detect it in *Tibellus* and various Epeirids. It is evident that in different species different amounts of muscular contraction and turgidity are necessary to effect the discharge of the sperms, and also, in all probability, to cause the erection of the spines.

All specimens of *Micrommata* do not reach maturity at the same season, but the most popular time for egg-laying, so far as my experience goes, is the latter half of July. One captive female laid her eggs on July 17th, 1920. Ten days later, when I visited their sanctuary in the woods near Wellington College, I found six females in company with their egg-cocoons. In the open spaces in these woods some small oak-seedlings are to be found, and five out of the six females were found on these, enclosed in cells formed by fastening three or four of the leaves together with strong white silk. The sixth female had placed her cocoon conspicuously amongst the grass. The eggs are green in colour.

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\* It should be remembered, however, that the spines are said (8, 9, 11) to be filled with cytoplasm, and not hollow and filled with the body-fluid.

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#### XIV.—Notes on the Aquatic Oligochæta of Travancore.—II.

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[Plates V. & VI.]

THREE species of *Æolosoma* and a Naid worm (possibly a new genus) are described in this paper. The species of *Æolosoma* were found in a glass basin of tank water with Hydrilla, brought to the laboratory for collecting Hydræ for class-work. The water was only examined for worms a month after it was brought, when the Hydrilla plants were in a fair state of decomposition.

#### Family Æolosomatidæ.

##### *Æolosoma* sp.

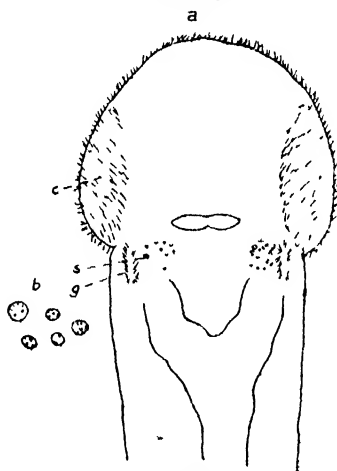
This worm, which occurs more abundantly than the two other species mentioned in this paper, is recognisable with the naked eye on account of its fairly large size, broad circular prostomium, and the long capilliform setæ. The worm glides along the smooth bottom of the glass basin like a Turbellarian.

The length of a chain of two individuals in the extended condition varies from 4 to 6 mm. The number of segments varies within wide limits. In an individual which did not show any sign of an approaching fission there were 15 segments, while in another, which was dividing, there were 12 segments in the anterior individual and 10 in the posterior.

In another chain of three individuals, the first had 11 segments, the second 6, and the third which was about to separate had 12.

The *Prostomium* is large, broader than the succeeding segments, thin, flat, and circular with a distinctly thick margin. The edges of the prostomium are sometimes seen to curl ventralwards. On the ventral side the thickened margin of each side is drawn inwards posteriorly towards the mid-ventral line, where it meets its fellow behind the mouth (text-fig. 2). Thus a shallow, more or less oval

Text-fig. 1.



*Æolosoma* sp.

- c. Ciliated area.
- s. Rounded bodies.
- g. Ciliated groove.
- b. s. (magnified).

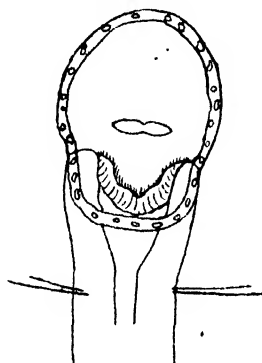
area with a thickened rim is formed which acts like a sucker. When the pipette is brought near an animal gliding along the bottom of the vessel and water gently squirted at it the tail-end is easily dislodged, but it is seen that a much greater force is necessary to free the anterior end, as the sucker is firmly applied to the substratum.

The mouth is wide and opens into the large funnel-like buccal cavity. The thick lower rim of the funnel is produced forwards on each side and is attached to the margin of the prostomium. The ventral surface of the prostomium and the lower rim of the buccal funnel are ciliated. These form

an efficient apparatus for driving minute organisms, such as diatoms, *Euglenæ*, etc., into the buccal cavity.

The dorsal surface of the prostomium presents on each side a biconvex ciliated area (text-fig. 1). Close to each

Text-fig. 2.

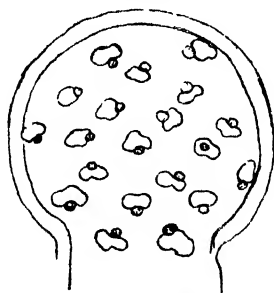


*Æolosoma* sp.

area along its inner border is seen a narrow channel extending up to the margin of the prostomium.

The integumental oil-drops are green with a light yellowish tinge, and are irregular in shape. In a few individuals the drops were of a light brown colour. They are present all

Text-fig. 3.



*Æolosoma* sp.

Oil-drops on prostomium.

over the body and are numerous on the upper surface of the prostomium and over the posterior end of the body. On the lower surface of the prostomium the drops were confined to the thickened margin (text-fig. 2). Attached to each

oil-drop is a small rounded or oval body filled with rapidly-moving granules (text-fig. 3). The movements of the granules can be made out only with the oil immersion lens. As these granular bodies are seen in connection with the oil-drops only, I am inclined to think that they are specialised epidermal cells having for their function the secretion of the oil-drops. The presence of granular cells in connection with the oil-drops does not seem to have been noted hitherto in any species of *Æolosoma*. They are not present in the two other species described in this paper.

*Setæ*.—The setæ are all capilliform, but are of two kinds—long and short. Each bundle consists of a variable number of the two kinds usually alternating with each other. The following arrangement may be taken as more or less typical of the species :—

Segment 2.....	2 long plus 2 short in each bundle.
"   3.....	2 " " 4 " "
"   4.....	3 " " 3 " "
"   5 to 12 .....	3 " " 3 " "

In a few individuals the number of setæ in each bundle was greater, as shown below. The largest number of setæ noted in a bundle was 9 :—

Segment 2.....	3 long and 5 short.	
"   3.....	3 " 5 " or 4 and 5.	
"   4-5.....	4 " 4 "	
"   6 to 12 .....	3 " 4 "	

The short seta is usually about half as long as the other. A long seta from the third segment of an individual measured  $249\mu$ , and a short one from the same bundle was  $114\mu$ . A long seta from the second segment of another individual was  $202\mu$ , and a short one from the same bundle was  $95\mu$ . Both kinds of setæ possess a slight sickle-shaped bend.

*Alimentary Canal*.—The buccal funnel opens into the sinuous narrow œsophagus which occupies segments 2 and 3. The stomach which occupies segments 4 to 8 is very wide, thick-walled, and of an orange colour. Like the rest of the alimentary canal the stomach is ciliated, the portion near the œsophageal opening being provided with long and strong cilia. Diatoms, encysted Euglenæ, and a Sporozoan parasite were observed in the stomach. The intestine begins in segment 9.

*Nephridia*.—Begin in the second segment, i. e., behind the first setal bundle (rarely only in the third segment), and are present in all the succeeding segments.

*Blood-vessels.*—There is a dorsal vessel which in the œsophageal region is quite conspicuous and rhythmically contractile. It lies on the side of the œsophagus and is a little wider than it. The vessel is continued forwards over the dorsal surface of the buccal funnel, and divides into two branches (a right and a left) behind the cerebral ganglion. The branches curve round the right and left sides of the buccal funnel and unite ventrally in the second segment in a line with the first setal bundle to form the ventral vessel. The rhythmic contractions of the dorsal vessel may be observed, not only as far as its anterior end, but also in the two branches for some distance. In the region of the stomach (and perhaps in the region of the intestine also) the dorsal vessel is in the form of a number of longitudinal sinuses on the wall of the alimentary canal.

The ventral vessel is easily made out, and extends from the second segment backwards to the posterior end. It is a straight vessel lying in the mid-ventral line, is non-contractile, and is of the same calibre throughout. It gives off in each segment a pair of small branches to the nephridia.

*Fission.*—The animal divides usually behind the eleventh segment, and sometimes behind the twelfth, and only very rarely behind the thirteenth. One or two new segments are formed at the hind end of the anterior individual. In two dividing individuals (out of a large number examined) it was noted that the first setigerous segments (*i. e.*, second segment) of the posterior individual was a new formation, but I am unable to say at present whether this is the rule in the species.

*The Brain* (text-figs. 1 & 2).—The brain is transversely elongated, and distinctly exhibits its bilobed character, being markedly indented both in front and behind.

*Sense Organ.*—A collection of very minute rounded bodies (appearing like black dots under the high-power) is seen on the dorsal surface of the prostomium on each side, a little behind the brain (text-fig. 1). These bodies are not quite on the surface, but a little below the epidermis. A short wide ciliated groove is present on the outer surface of each cluster. The ciliated groove is almost in a line with, and appears to communicate with, the narrow channel which runs close to the inner border of the biconvex ciliated area mentioned above. (This channel does not appear to be a permanent structure and comes into view only occasionally.)

It seems probable that the collection of minute bodies mentioned above and the ciliated groove in connection with it constitute a kind of sense-organ; but further investi-



gations are necessary before anything can be said of its exact nature and function. I am inclined to think that the wide ciliated groove probably leads into a sac in which the bodies mentioned are present, and that the invisibility of the sac is due to its getting considerably flattened out by the pressure of the cover-slip.

This species agrees with *Æ. bengalense* described by Stephenson (2) in the following respects :—

1. Position of zone of fission.
2. Two kinds of capilliform setæ, the average length of the long seta being twice that of the short one.
3. The extent and colour of the stomach.

It differs, however, in possessing two biconvex ciliated areas on the dorsal surface of the prostomium, in the presence of a pair of ciliated sense-organs, and in the occurrence of granular cells in connection with the oil-globules.

NOTE BY DR. J. STEPHENSON.—Mr. Aiyer has been kind enough to send me specimens of the above species of *Æolosoma*, which he has not named. I believe it is identical with *Æ. bengalensis*, which I described in 1911. The ciliated areas on the prostomium, the ciliated sense-organs, and the granular cells in connection with the oil-globules would not be visible in spirit-specimens such as those from which my description was written; these features are not to be made out in the specimens Mr. Aiyer has sent me. The chief difference between the two worms seems to be the larger number of long setæ in the setal bundles of the Travancore specimens—two to four against one or two—and the slight sickle-shaped curve of the setæ of Mr. Aiyer's worms. There may really be a slight difference in this latter respect or I may have overlooked the curvature, or put it down to the pressure of the cover-slip and so disregarded it. The length of the preserved specimens of the Travancore worms is much the same as that given for *Æ. bengalensis*.

*Æolosoma travancorensis*, sp. n.

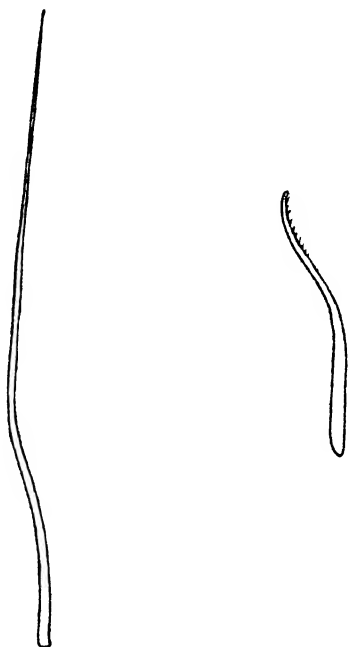
This is a very minute worm, the length of an individual or chain in the extended condition varying from 0·8 mm. to 1·5 mm. Its minute size, coupled with its transparency, makes it difficult to detect it. The worm moves by a series of contractions which pass over the body in a succession of waves.

The prostomium is broader than the succeeding segments. The rounded anterior margin of the prostomium bears a few flexible hair-like processes. A few such processes are also seen at the posterior end of the body.

Oil-globules are entirely absent in the integument. On the prostomium and scattered sparsely on the whole surface of the body are rounded aggregations of minute, more or less circular, colourless particles. Each aggregate has an average diameter of  $9\mu$ .

*Alimentary Tract.*—The œsophagus is sinuous and narrow, and occupies segments 2 and 3. The stomach, which is yellowish in colour, occupies segments 4 to 7, practically

Text-figs. 4 & 4 a.



*Æolosoma travancorense.*  
Capilliform seta.

*Æolosoma travancorense.*  
Serrate seta

filling the body-cavity in this region. The intestine begins in the posterior half of segment 7.

*Nephridia* begin in segment 3 behind the second setal bundle.

*Setæ.*—Setæ are of two kinds—one the long capilliform type and the other short and serrate. The capilliform seta (text-fig. 4) is  $57\mu$  long, with a slight but distinct bayonet-shaped bend at about the end of the proximal third. The shorter seta (text-fig. 4 a) requires a detailed description.

Each is about  $34\mu$  in length and has a distinct bayonet-bend like the hair-seta. When examined with the oil immersion lens the inner (concave) border of the bent distal portion is seen to be provided with two rows of very minute curved teeth. When such a seta is examined lying on its side one row of teeth only is visible, but, as the setæ lie in all sorts of positions in the mounting medium, several could be seen with the concave side turned upwards. In these, of course, the bayonet-bend could not be seen, the setæ appearing straight. When one such is examined it is seen that each margin of the distal portion is raised up into a ridge bearing a row of teeth (the teeth looking like minute knobs). The teeth begin about the middle of the bend and 6 to 8 could be counted in each row. Distally the seta ends in a pair of claw-like teeth.

The number of each kind of seta in a bundle varies slightly. The following arrangement observed in a chain may be taken as more or less typical:—

	Dorsal.	Ventral.
Second segment . . . . .	4 cap.	4 cap.
Third       "       . . . . .	4 cap.	4 cap. plus 2 ser.
Fourth       "       . . . . .	3 cap. plus 1 ser.	4 cap. plus 2 ser.
Fifth        "       . . . . .	2 cap. plus 2 ser.	2 cap. plus 2 ser.
Sixth        "       . . . . .	1 cap. plus 2 ser.	2 cap. plus 2 ser.
Seventh     "       . . . . .	1 cap. plus 2 ser.	3 ser.
Eighth (new) segment . .	2 needle-like setæ.	2 needles.

In the posterior individual:—

Second, third, fourth, and fifth segments . .	1 cap. plus 1 ser.	2 ser.
Sixth and seventh seg- ments . . . . .	1 cap.	1 ser.

[cap.=capilliform; ser.=serrate].

The serrate setæ begin in the third segment only. They were never noted in the second segment.

### *Æolosoma kashyapi*, Steph.

This species occurs along with the other two, and is of the same length as the preceding one, the worm in a fairly extended position measuring from 0·8 to 1·6 mm.

The *Prostomium* is distinctly broader than the succeeding segments, and is flat and thin. When the worm moves along, the edges of the prostomium are sometimes seen to curl ventralwards. Tactile hairs are absent on the prostomium, though a few occur at the posterior end of the animal.

The *oil-drops*, which are numerous on the prostomium and

on the whole surface of the body, are of a deep orange colour and very conspicuous, the brightly-spotted worm looking extremely pretty under the microscope. The globules are oval or roughly circular, and are on an average about  $6\mu$  in diameter. When the live worm has been under the microscope for some time subjected to the pressure of the cover-slip, the globules gradually begin to break up—each globule changing to a light violet colour and then suddenly breaking up into a number of minute violet particles.

The setæ are all capilliform and almost straight, and occur from 2 to 5 in each bundle. Some setæ are long and some short, the long setæ being roughly twice the length of the short. The long seta is about  $66\mu$  in length, while the short is  $38\mu$ . The arrangement in one of my specimens was as follows:—

Second segment	.....	3 long plus 1 short in each bundle.
Third	„	..... 4 or 5 long (no short setæ).
Fourth	„	..... 3 long plus 2 short.
Fifth	„	..... 4 long.
Sixth	„	..... 2 long plus 2 short.
Seventh	„	..... 2 long plus 2 short.

*Fission*.—A large number of dividing individuals were examined, and fission was in every case found to be between the eighth and ninth segments;  $n$  is therefore always 8.

*Nephridia* begin in the third segment, behind the second setal bundles, and are present in all the succeeding segments. Quite exceptionally they were found to be absent in the fifth segment.

The stomach occupies three segments (segments 4 to 6), and the intestine begins in segment 7.

### Family Naididæ.

#### *Naidium* (?) *trivandranum*, sp. n.

Specimens of this interesting worm were obtained from soft mud from an old tank in Trivandrum. The worm can be easily detected and recognised by its pale white and almost opaque body-wall. It moves very slowly, and when disturbed coils itself up immediately into a flat spiral like a millipede or screws itself up into an irregular spiral, like an *Aulodrilus*.

The worm measures from 2 to 6 mm. in the extended condition, and the number of segments varies from 21 to 43. The last three or four segments at the posterior end are without setæ. When the worm is examined under the microscope, the body-wall, which is closely annulated, is

seen to be covered with a thin mucilaginous sheath to which foreign particles adhere in circular rows round the annuli. This gives the body-wall of a contracted worm a papillated appearance (Pl. V. fig. 1). Colourless filament-like cryptocamic growths were noticed on the sheaths of a few individuals.

*The Prostomium* is triangular and bluntly pointed in the living worm, but assumes a rounded form when killed.

*Setæ*.—Both dorsal and ventral bundles begin in segment 2. In the anterior segments the dorsal bundles consist of three or four needles and three or four hair-setæ. From about the twelfth segment the number of each kind in a bundle becomes reduced to 2 and further back to 1. The needles are 38 to 48  $\mu$  long and suddenly taper towards the distal end. The hair-setæ are slightly sickle-shaped and are about 145  $\mu$  in length. The ventral bundles consist of three or four doubled pronged crotchets in the anterior segments. From about the twelfth segment the number is reduced to 2 and further posteriorly to 1. The ventral setæ (Pl. VI. fig. 2) measure from 75 to 90  $\mu$ , and have a nodulus which is proximal to the middle of the shaft. The outer prong is thinner and longer than the inner and ends in a fine sharp point. The ventral setæ of the anterior segments do not show any marked difference from those of the succeeding segments.

*Alimentary tracts*.—The wide pharynx occupies segment 2 and part of segment 3. The œsophagus which begins in the third segment is narrow and sinuous, and widens in the sixth or seventh segment to form the intestine. The pharynx is surrounded by clear cells, which may be glandular in nature. There is no stomachal dilatation. The intestine and the distal half of the œsophagus are covered on the outside by minute bodies looking like oil-droplets (Pl. VI. fig. 3). Scattered throughout the intestine are patches of a reddish-orange pigment, accumulations of such patches being prominent at the posterior end.

*Blood-vessels*.—The dorsal vessel is lateral in position and lies on the left side of the alimentary canal from the hinder end to segment 6. A pair of contractile hearts are present in segment 5 in front of septum 5/6. After making a spiral twist in segment 4 the dorsal vessel rises upwards to the mid-dorsal line and runs forwards.

The ventral vessel is mid-ventral in position and lies above the nerve-cord.

*Nephridia* commence in segment 6 and are present in all

succeeding segments. In some cases the nephridia were seen to begin in segment 5. I believe that these specimens are only newly budded off individuals which have not lost the nephridia in the fifth segment (the first segment which is derived from the original individual). Each nephridium begins as a small rounded ciliated funnel in front of the septum; the tube then passes through the septum and immediately becomes dilated into a pear-shaped vesicle, after which it is continued as a long tube thrown into three or four long coils.

*Reproduction.*—No sexual specimens have yet been obtained.

Out of a large number of specimens examined five individuals only showed fission. In these  $n=20$ . The first indication of the approaching fission is a constriction round the body between segments 20 and 21 (Pl. VI. fig. 4). In about 24 hours a distinct budding-zone is formed. The prostomium and the first four segments of the posterior animal are found in the budding-zone, while no new segments appear to be added to the anterior animal. Thus in this species the second animal of a chain derives only the first four segments (i.e., the first segment and the first three setigerous segments) of its body from the budding-zone. Sometimes the individuals appear to separate before these segments are fully developed, as specimens have been obtained in which the first three setigerous segments were in different stages of development (Pl. VI. fig. 6).

*Systematic Position.*—The systematic position of the worm is not clear. It is not referable to any of the existing genera of Naididæ. Following Stephenson's key to the Indian genera of this family (1), it should be placed under *Naidium*. But it differs from the two known Indian species of this genus in such important characters as the single pointed needles of the dorsal bundles, absence of cœlomic corpuscles and stomachal dilatation, and in the fact that the second animal of a chain derives only the first four segments of its body from the budding-zone. The worm resembles *Nais* in certain respects, but it is doubtful if it can be placed under that genus, since the dorsal bundles in all species of *Nais* begin in segment 6. It cannot be included in *Slavina* for the same reason.

Perhaps sexual individuals will clear up the position, or perhaps a new genus will have to be created for the reception of this worm.

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## EXPLANATION OF THE PLATES.

[All the figures are of *Naidium* (?) *trivandranum*.]

## PLATE V.

Fig. 1. (Specimen killed with hot formalin.) The papillæ-like bodies are foreign particles adhering to the mucous coat.

## PLATE VI.

Fig. 2. Ventral seta.

Fig. 3. Fifth and sixth segments. *d.v.*, dorsal vessel; *ht.*, heart; *nph.*, nephridium; *n.c.*, nerve-cord; *g.*, oil-droplets on the intestine.

Fig. 4. Constriction formed between segments xx. and xxi. preparatory to fission.

Fig. 5. The same region examined 24 hours later. Zone of fission with four new segments.

Fig. 6. Head-end of a newly budded-off individual—without fully developed anterior segments.

XV.—*Cyclops lacunæ*, a new Species of Cyclops. By A. G. LOWNDES, M.A., F.L.S., Biologist, Marlborough College.

[Plate VII.]

*Cyclops lacunæ*, sp. n.

This species closely resembles *Cyclops pictus*, Koch, syn. *Cyclops strenuus*, Fischer. There are, however, so many points in which it differs from the above-named species that it appears necessary to give it specific rank.

This view is strongly held by Prof. G. O. Sars, who kindly examined specimens for me.

*Specific Characters*.—Female.

Length 1.5–1.7 mm., exclusive of apical setæ.

The body is somewhat slender, with the anterior division oval in form. Distinctly tapering towards the last trunk-segments. The length of the trunk is about twice the

greatest width. The cephalic segment is as broad as it is long, and its length slightly exceeds the length of the four succeeding segments combined.

The lateral parts of the last two trunk-segments are produced, and form in each segment a point that is turned somewhat outwards. The tail is attenuated, and exceeds slightly half the length of the anterior division.

The caudal rami are long and slender, their length being as much as eight times their width in their narrowest part. They are as long as the last three segments combined. They bear a longitudinal keel dorsally, and their inner edges bear a few scattered and inconspicuous hairs.

The setæ of the outer edge is small and about four-fifths of the way along the rami. The rami are only slightly divergent. Both the inner and outer corner setæ are very fine. The ratio of the inner corner seta to the outer is 3:2, while the ratio of the caudal rami to the inner corner setæ is 5:3. The apical setæ are long and fine. The inner apical seta is the longer, its length being quite twice the length of the rami, and it is practically equal to the length of the tail.

All the setæ attached to the caudal rami are very fine, and present a striking contrast with the short stout setæ that are so characteristic of *C. pictus*.

The anterior antennæ are of moderate length. They consist of seventeen joints, and reach as far as the middle of the second segment when reflexed. The last three joints bear a hyaline membrane that is distinctly toothed, though the teeth are only seen under a high magnification.

The posterior antennæ are rather short.

The spine-formula for the four swimming-feet shows considerable variation. The number of setæ on the end joint of the outer ramus in all the feet being without exception 5. The spines show, however, the following variations:—3.3.3.3 or 2.3.3.3 or 3.4.3.3.

The last pair of legs are two-jointed and are identical with those of *C. pictus*.

The ovisacs are usually small and sometimes almost globular; they are borne closely appressed.

The genital segment is characteristic. It is strongly dilated in front. Its breadth often exceeds its length and its length exceeds that of the three succeeding segments.

The seminal receptacle is somewhat triangular in outline, the base of the triangle being in front.

*Colour*.—A conspicuous orange or yellow, which is quite characteristic.



*Diagnosis.*—From the above description it will be seen that there is only one species with which *C. lacunæ* could be confounded—namely, *C. pictus*. From this species it is easily distinguished, even without a microscope. *C. pictus*, as it occurs in this district, usually exceeds 2 mm. It is much more robust in appearance, owing to the greater width of the two last trunk-segments. The ovisacs are also considerably larger and more elongated. Its colour is much less conspicuous.

Under the microscope *C. lacunæ* differs from *C. pictus* in the following respects:—(1) The great length and fineness of the apical setæ; (2) the elongated caudal rami; (3) the much more attenuated tail-segments; (4) the paucity of hairs along the inner edges of the caudal rami.

*Occurrence.*—This species has only been found in three small ponds in the Marlborough district, all of which are subject to desiccation. The pH value of the water in which the animal was found varied from 6·6–8·2.

#### EXPLANATION OF PLATE VII.

*Fig. 1.* *Cyclops lacunæ*, sp. n.

*Fig. 2.* Genital segment and seminal receptacle.

*Fig. 3.* Caudal rami.

XVI.—*On the Lower Carboniferous Corals: Orionastræa indivisa, sp. n., and Thysanophyllum prædictum, sp. n.*  
By R. G. S. HUDSON, M.Sc., F.G.S.

[Plate VIII.]

#### I.

The corals described in this paper were found during an investigation of the fauna and sedimentation of the Lower Carboniferous of North-West Yorkshire. Numerous hitherto undescribed or imperfectly-known forms have been obtained both from the Yoredale facies of the Lower Carboniferous—a facies characterised by the persistence of the coral-brachiopod phase to high horizons—and from the Culm and reef-limestone facies, in which the coral-phase is rare. In this paper only those forms are described which have some immediate bearing on the evolutionary aspect of coral-structure or else are important from a zonal point of view.

The writer records his thanks to Dr. W. D. Lang for criticism and advice in connection with the arrangement of this paper.

## II.

## ORIONASTRÆA, Stanley Smith, emended.

*Diagnosis.* Rugose Corals resembling *Lithostrotion* and allied forms, but differing from these in having either no septa or the septa in neighbouring corallites confluent.

*Distribution.* Lower Carboniferous, horizons D<sub>2</sub>-O, England.

*Genotype.* *Sarcinula phillipsi*, McCoy, 1849, Ann. & Mag. Nat. Hist. ser. 2, vol. iii. p. 125.

*Remarks.* The genus *Orionastræa*, founded by Stanley Smith \*, includes three species, *O. ensifer*, *O. phillipsi*, and *O. placenta*, which are shown to be closely related to *Lithostrotion*, and probably to represent the phylogerontic stage in a lineage of the Lithostrotionidæ. The genus shows a progressive simplification of structural elements in the absence of an epitheca between the corallites and the confluence of the septa of adjacent corallites. The species described below shows a further modification of the structure in that the septa are suppressed and the coral is composed of dissepiments, theca, tabulæ, and colonial epitheca only.

*Orionastræa indivisa*, sp. n. (Pl. VIII. figs. 1, 2.)

*Orionastræa*, sp. n., R. G. S. Hudson, 1925, Geol. Mag. vol. lxii. p. 185.

*Diagnosis.* *Orionastræa* with no septa.

*Description.*—*External Characters.* The corallum is either depressed, mainly growing outwards, and only a few cm. thick (Pl. VIII. fig. 1); or else it is more massive with upright corallites, in which case it attains an average thickness of 5 cm. (Pl. VIII. fig. 2). The proximal surface is covered with thin epitheca, while the distal surface is usually smooth and flat with the calices showing as small depressions.

*Internal Characters.* As seen in transverse section, the corallites are composed of dissepiments convex towards the theca, and surrounding an intrathecal area occupied only by the cut edges of the tabulæ. Neither septa nor columella are present. A complete theca appears only when the intrathecal column is approximately vertical to the plane section (Pl. VIII. fig. 1 a); where it is oblique the tabulæ merge into the dissepiments and no theca is seen on the inner side of the column (Pl. VIII. fig. 1 b). The thecal dissepiments

\* Stanley Smith, *Aulina rotiformis*, gen. et sp. n., *Phillipsastræa kennahi* (Lonsdale), and *Orionastræa*, gen. nov., Q. J. G. S. vol. lxii. (1916), pp. 280-307, pls. xxii.-xxiv.

(i. e., the two or three rings of dissepiments immediately surrounding the theca) are smaller and more regular than those at a distance from the theca.

As seen in longitudinal section, the tabulæ are curved, either distally concave, and then extending across the intrathecal column (Pl. VIII. fig. 2 *b*); or else are slightly arched, rarely extending across the intrathecal column but inclined downwards to rest on earlier tabulæ, thus forming structures distally concave (Pl. VIII. fig. 1 *c*). The dissepiments are arched, thin, and horizontally disposed, except the much flattened thecal dissepiments, which are nearly vertical and whose inner edges coalesce to form the theca. Where the intrathecal column turns outwards, and thus crosses a vertical section obliquely, dissepiments on the upper side appear to pass directly into the tabulæ.

*Distribution.* *O. indivisa* has hitherto been recorded from the Lower Carboniferous of North-West Yorkshire only. There it has a narrow vertical range, and is the chief element in a faunal band in the *Orionastræa* zone\*. Where the formation, as in N.W. Yorkshire, is divided by a series of limestones, it is found at the top of the Simonstone Limestone. It also occurs with (or below) *O. phillipsi* in the *Orionastræa* band recorded from the Settle district†. The absence of any vertically-elongated skeletal element enables it to be easily crushed, and it is often so found. It is also often silicified, being replaced by chert (Pl. VIII. fig. 2). Examples of *O. indivisa* have been collected from the many localities in Wensleydale and Swaledale, notably from Birks Gill near Low Row, Swaledale, and from Sar Gill, near Askrigg, Wensleydale. It has also been collected from the top of the Simonstone Limestone in East Wharfedale, from the *Orionastræa* band at Feizor, near Settle, from Cow Gill, Bordley, near Malham‡, and from the inlier of Simonstone Limestone at Toft Gate, near Pateley Bridge.

*Holotype.* British Museum, R. 25235 and sections cut from it, R. 25236 (Pl. VIII. fig. 1 *a*), R. 25237 (Pl. VIII. fig. 1 *b*), and R. 25238 (Pl. VIII. fig. 1 *c*). Lower Carboniferous, Yoredalian, *Orionastræa*-zone, Birks Gill, High Whitaside, near Low Row, Swaledale, Yorks.

*Remarks.* *Orionastræa indivisa* is distinguished from *O. phillipsi* not only by the absence of septa and a columella,

\* "Lower Carboniferous Zonal Nomenclature," Rept. Brit. Assoc. for 1925 (Southampton), 1926, p. 256.

† E. J. Garwood and E. Goodyear, Q. J. G. S. vol. lxxx. 1924, pp. 205-207.

‡ Garwood and Goodyear, *op. cit.* p. 252.

but also by the difference in structure of the dissepiments and tabulæ. The small regular dissepiments of *O. phillipsi* are replaced in *O. indivisa* by large irregular dissepiments, and the arched simple tabulæ by depressed compound tabulæ. *O. placenta* bears a much greater resemblance to *O. indivisa*, not only in the absence of a columella but in the dissepiments, which in *O. placenta* are irregular and approach the very irregular dissepiments of *O. indivisa* \*. There is a tendency, too, in *O. placenta* towards a distal shortening of the septa †.

It is noteworthy that certain specimens of this or an allied species show vestigial septa (Pl. VIII. fig. 3). These septa are discontinuous and are usually grouped around the theca,

Fig. 1.

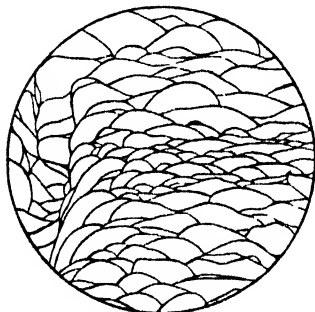


Fig. 2.

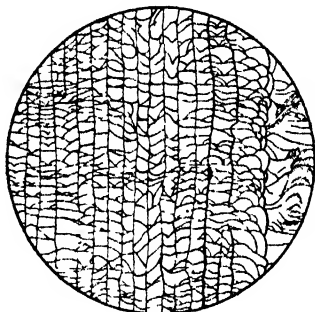


Fig. 1.—Vertical section of *Orionastræa indivisa*.  $\times 5$ .

Fig. 2.—Vertical section of *Orionastræa phillipsi*.  $\times 5$ . The shading in the thecal column represents the oblique sections of septa and columella.

The above figures show that in *O. phillipsi* the dissepiments are not the continuous structures that they are in *O. indivisa*.

never extending far towards the periphery of the corallite. Seen in transverse section, they originate on the convex (thecal) side of a dissepiment and rarely extend completely across to the next dissepiment. In a longitudinal section they are seen as vertical rods, passing through several dissepiments and ending midway between two of them. Occasionally incipient septa are seen in individual corallites of *O. indivisa*. An interesting point regarding the origin of the septa is shown in text-figs. 1 and 2. The longitudinal

\* S. Smith, *op. cit.* fig. 1, p. 283. This section, abnormal in that it is cut between the septa and showing only tabulæ and dissepiments, differs very little from a normal section of *O. indivisa*.

† S. Smith, *op. cit.* pl. xxii. fig. 8.

section of *O. phillipsi* shows that the dissepiments are discontinuous, abutting against the septa. In *O. indivisa* the dissepiments are continuous and uninterrupted by septa. This disposes of the argument that the lack of septa in *O. indivisa* may be due to the unequal preservation of dissepiments and septa. It seems probable that the suppression of the septa in *O. indivisa* was a gradual process, the final result of the Lonsdaleoid trend of coral evolution emphasized by W. D. Lang\*.

The earlier portions of the corallum show the outward growth of the coral by the overlapping of the dissepiments and by the outward inclination of the intrathecal column. The epitheca is comparatively thick, and the earliest dissepiments, which rest upon it, are often more regular than the later ones. An occasional re-growth of the epitheca occurs in the later stages of the coral, and this is accompanied by the re-appearance of the epithecal dissepiments.

*Phylogeny.* Dr. Stanley Smith has suggested that *O. phillipsi* and *O. placenta* are derived from some such *Lithostrotion* as *L. basaltiforme* and that *O. ensifer* is a link between *Lithostrotion* and *O. phillipsi*. The writer suggests that *O. indivisa* is the end form of another *Lithostrotion* lineage, one in which the dissepiments are less regular than in the *ensifer-philipsi* stock, and that *O. placenta* is a form intermediate between such a *Lithostrotion* and *O. indivisa*†. *O. phillipsi* and *O. indivisa*, it is suggested, are polyphyletic forms.

### III.

#### THYSANOPHYLLUM, Nicholson & Thomson.

*Diagnosis.* Clisiophyllid corals resembling *Lonsdaleia*, but having no central column.

*Distribution.* Lower Carboniferous, Viséan and Yoredalian. Great Britain.

*Genosyntypes.* *T. orientale*, Nicholson & Thomson, and *T. minus*, Nicholson & Thomson.

\* W. D. Lang, "Trends in British Carboniferous Corals," Proc. Geol. Assoc. vol. xxxiv. 1923, pp. 120-136.

† *Lithostrotion* sp. (B.M. specimen R. 15829), from Port Eynon, Gower, and recorded by Vaughan (Q. J. G. S. vol. lxvii. 1911, p. 549) as *Petalaxis portlocki*, Ed. & H., is such a form. In this species the septa of many corallites do not reach the epitheca, and the extra-septal dissepiments thus formed are very irregular and resemble those of *O. indivisa*. The epitheca is occasionally absent, and elsewhere is often very thin, characters which suggest a relation to *Orionastræa*.

*Genoelectotype. T. orientale*, Nicholson & Thomson. Here chosen.

*Remarks.* *Thysanophyllum* was founded by H. A. Nicholson & J. Thomson (1876, Proc. Roy. Soc. Edinburgh, vol. ix. p. 150) for two new species, which they name *T. orientale* and *T. minus*, but do not describe.

In 1881 (Proc. Phil. Soc. Glasgow, vol. xii. pp. 255-58) J. Thomson defined *Thysanophyllum*, and described and figured the two new species (pl. iii. figs. 11, 12, 14). He reproduced pl. iii. figs. 11, 11 a, of *T. orientale*, as text-fig. 4 on p. 255 in the description of *Thysanophyllum*, thus implying that *T. orientale* was the genotype, but not definitely choosing it. By now definitely choosing *T. orientale* as lectotype of *Thysanophyllum* I confirm Thomson's manifest intention.

Of the three species hitherto assigned to this genus *T. pseudovermiculare* (McCoy)\* is a phaceloid form and *T. orientale* and *T. minus* are cerioid forms. The *Thysanophyllum* described in this paper is cerioid and bears considerable resemblance both to *T. orientalis* and *T. minus*, combining in the one form structures peculiar to either *T. orientale* or *T. minus*. In view, however, of the loss of holotypes of the above forms and the lack of specimens from the type-localities which are referable to Thomson's species, the form described here has been referred to a new species, *Thysanophyllum prædictum*.

*Thysanophyllum prædictum*, sp. n.

*Diagnosis.* Cerioid *Thysanophyllum* with about twenty septa in the ephebic stages (that is, less than the other known species), and otherwise resembling *T. minus* in the neanic stages and *T. orientale* in the ephebic stages, but having fewer dissepiments than either of these species.

*Description.*—*External Characters.* The corallum is cerioid and no free corallites have been seen. The corallites are polygonal and easily separated the one from the other. The epitheca is very rugose and the interseptal ridges are only slightly developed.

*Internal Characters.* As seen in transverse section (Pl. VIII. figs. 4 a, 4 b), the septa, which in the ephebic corallites extend from the theca halfway across the tabulate area, are slightly flexuous and are about twenty in number. They

\* The structure and relationship of *T. pseudovermiculare* has been discussed by Garwood, Q. J. G. S. vol. lxxviii. 1912, p. 252, and by Stanley Smith, Q. J. G. S. vol. lxxi. 1916, p. 235.

often extend beyond the theca and across the first dissepimental ring, but rarely, in the ephebic stage, beyond that. In the neanic stage, one septum (the counter-septum, by analogy with the other Clisiophyllids) extends into the centre of the corallite. Very short minor septa are present in the fully developed corallite. The dissepiments are large and irregular, and there is rarely more than one dissepimental ring between the theca and the epitheca.

As seen in the longitudinal section (figs. 4c-4e), the tabulæ, in the ephebic stage, are horizontal or slightly concave. In the neanic stage they are bisected by the prolonged counter-septum, and each half is then seen to be curved, concave, and, with its corresponding half, makes a sharp upwardly directed point on meeting the counter-septum (Vaughan, *Endophyllum* or *T. cf. vermiculare*, Quart. Journ. Geol. Soc. vol. lxxi. 1915, p. 39). The dissepiments, of which there is rarely more than one ring, are steeply inclined and thickened on their inner vertical edges to form a thecal wall. The prolonged counter-septum, seen in the neanic stage, is thin and very flexuous.

*Ontogeny*\*. The development of *T. prædictum* is an expansion of the early neanic development of the Clisiophyllids.

Early brephic stage: The corallite consists of a ring of epitheca which contains only a few basal tabulæ (Pl. VIII. fig. 4e).

Late brephic stage: Septa develop and one septum (by analogy, the counter-cardinal) stretches across the centre of the corallite towards the cardinal septum. At this stage, the tabulæ are steeply inclined to the medial septum ( $\beta$ , Pl. VIII. fig. 4e, and  $\alpha$ , Pl. VIII. fig. 4b).

Neanic stage: Extra-septal dissepiments appear on both sides of the corallite ( $\beta$ , Pl. VIII. fig. 4b) and gradually encircle it ( $\gamma$ , Pl. VIII. fig. 4b). The counter-septum extends only to the centre of the corallite. The tabulæ become more horizontal and arch to meet the counter-septum (Pl. VIII. fig. 4c).

Ephebic stage: The counter-septum shortens and cannot be distinguished from the other septa which increase to twenty ( $\delta$ , Pl. VIII. fig. 4b); minor septa are present and the tabulæ become slightly concave (ephebic corallite, Pl. VIII. fig. 4e).

*Distribution*. Lower Carboniferous, Yoredalian, Main Limestone, Yorkshire.

*Holotype*. British Museum, R. 25244 and sections cut

\* A note on the suggested relation of *T. prædictum* to *Lonsdaleia* is deferred to a later paper on a new species of *Lonsdaleia*.

from it, R. 25245 (Pl. VIII. fig. 4 a), R. 25246 (Pl. VIII. fig. 4 b), R. 25247 (Pl. VIII. fig. 4 c), R. 25248 (Pl. VIII. fig. 4 d), and R. 25249 (Pl. VIII. fig. 4 e). East Gill, Cotterdale, Wensleydale, Yorkshire.

## EXPLANATION OF PLATE VIII.

Figs. 1-3 are from *Orionastræa*-zone, Yoredalian, Lower Carboniferous, and are magnified two diameters.

*Fig. 1.* *Orionastræa indivisa*, sp. n. Depressed variety. Section cut from holotype (R. 25235). Simonstone Limestone, Birks Gill, High Whitaside, near Low Row, Swaledale, Yorkshire.

*Fig. 1 a.* Transverse section from centre of corallum showing upright thecal columns (R. 25236).

*Fig. 1 b.* Transverse section from centre to edge of corallum showing oblique thecal columns (R. 25237).

*Fig. 1 c.* Longitudinal section (R. 25238).

*Fig. 2.* *Orionastræa indivisa*. Massive variety. Sections cut from paratype (R. 25239). Simonstone Limestone, Whernside Pasture, Great Whernside near Kettlewell, Wharfedale.

*Fig. 2 a.* Transverse section (R. 25240).

*Fig. 2 b.* Longitudinal section (R. 25241).

*Fig. 3.* *Orionastræa* aff. *indivisa*. Longitudinal section (R. 25243) from specimen R. 25242. *Orionastræa*-band, Cow Gill, near Bordley, Malham. Shows degenerate septa.

*Fig. 4.* *Thysanophyllum prædictum*, sp. n. Sections cut from holotype (R. 25244). Main Limestone, East Gill, Cotterdale, Wensleydale, Yorkshire.

*Figs. 4 a, 4 b.* Transverse sections (R. 25245-6).  $\times 1.5$ .

*Figs. 4 c, 4 d.* Longitudinal sections (R. 25247-8).  $\times 1.5$ .

*Fig. 4 e.* Longitudinal section (R. 25249).  $\times 1.5$ . One corallite in ephelic and the other in brephic and neanic stages.

## XVII.—The Brain of Archæopteryx.

By TILLY EDINGER, Dr. phil. nat. (Frankfurt a. M.).

SINCE Owen, in his original memoir on the *Archæopteryx* (1864), stated that in the British Museum specimen the skull was lacking, this has always been reiterated as a fact. Yet Evans, before Owens's work was published, had already pointed out the probability that a definite projection on the principal slab, near the outer edge of the right wing, was a cast of the brain-cavity of the *Archæopteryx* and that its encircling line as well as its impression on the counterpart were parts of the cranium. Owen, in his explanation of the plates, when designating this particular part, refers to Evans's opinion as follows: "*n*. Concretionary nodules: the larger one consists of matrix, which filled a cavity, *n'*, formed by a



thin layer of brownish, crystalline matter ; which may be, as suggested by Mr. John Evans, F.G.S., part of the cranium with the cast of the brain of the *Archæopteryx*." Mackie (1863), with the assistance of Carter Blake, even identified certain parts of the brain in this protuberance, and Evans himself, in 1865, published his unchanged view of the matter.

Meanwhile, the existence of these remains has been almost forgotten. All text-books mention the Saururæ-skull as if preserved only in the Berlin specimen. It was only when collating the literature on fossil brains that I came across the papers by Evans and Mackie. Enquiry in London led to a charming and most welcome invitation from Dr. F. A. Bather, Keeper of Geology in the British Museum, to come over and examine the specimen personally. Further development of the brain was to be undertaken to facilitate my investigations. The studies carried out at the British Museum proved a pleasure, for which I am greatly indebted to Dr. Bather and Miss Dorothea Bate.

Even to the naked eye it was at once visible that here was the natural cast of the brain-cavity, of which not quite one-half, seen in profile, emerges from the slab. Within the slab, however, it is surrounded by remains of the skull, whose intersecting line encloses the cast on the surface of the slab and continues from there in a curved line. All further preparation, therefore, could only develop more parts of the skull ; and this preparation was successfully carried on by Mr. Parsons' skilled hands. The brain was revealed no more than it had been all along.

Figs. 1 and 2, drawn by Miss G. M. Woodward, show the skull-region of the principal slab in its present stage of preparation (April 1926). In fig. 1 we look perpendicularly at the slab, in fig. 2 we look along its surface. The brain-cast is represented in stipples, the bones with lines ; the hatching is the matrix.

The form of the visible part of the brain is bipartite. If the boundary-line running parallel to the nearest edge of the slab be taken as the base, one longish (I) and one smaller, more rounded protuberance (II) rise from it. If the slab be placed upright, with the bird's tail at the bottom, the smaller protuberance becomes topmost, the larger one is below it. Measured parallel to the base, the upper protuberance (II) is 5.5 mm., the lower one 11 mm. long. As the latter is strongly curved, the real length of its upper surface is 16 mm. The maximum height of both parts is 6 mm. A furrow (*f* 1) separates the two hillocks. Parallel

to this furrow and 2 mm. lower down, a less marked furrow runs over the elongated protuberance (*f 2*).

The surface of the cast is otherwise absolutely smooth. In contrast to its conchoidally fractured surroundings and the rough concretions on the counter-slab (to which it has mistakenly been compared), it appears as the cast or drusy filling of a cavity, similar to the natural casts seen in the medullary spaces of some limb-bones of the *Archæopteryx*. Consequently, at the corresponding place on the counterpart lies the piece of bone (Owen's *n'*), which yielded an impression conforming to the above-described object—the form of the right side of a brain.

Fig 1.

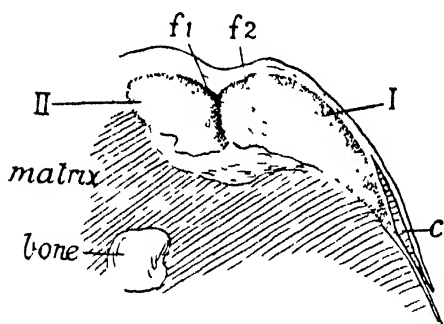


Fig. 2.

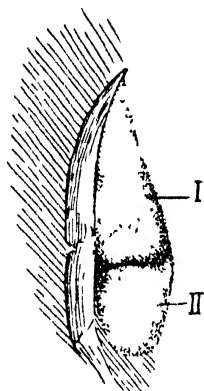


Fig. 1.—*Archæopteryx lithographica*, v. Meyer, natural cast of brain-cavity, partly exposed, from right side.  $\times 2$ .

Fig. 2.—The cast seen from above.  $\times 2$ .

Strange to say, Evans, as well as Mackie and Carter Blake, thought he was looking at the brain from in front; the site of the olfactory lobes, together with the median line of the hemispheres running towards them, were even identified. Mackie's illustration, identical with the Diagrammatic Sketch in the Natural History Museum Guide to the Fossil Mammals and Birds (1923, fig. 85), also shows the object quite symmetrical, the true outline being only denoted by shading. Owens's illustration had been quite correct.

In fact, the head of the *Archæopteryx* did not sink with its back in the mud. It lies in relation to the body in a similar post-mortem natural place, as in the *Archæornis*, and

likewise lies in the same position on its left side, though certainly broken up. This situation should also dispel any existing doubt as to the nature of the natural cast; it corresponds to the brain of this primeval bird.

The explanation of its configuration is difficult, owing to the incomplete state of preparation of the cranium. The complete comprehension of a fossil brain, especially of one which is only partly visible, requires a knowledge of the cranium. At present further preparation cannot be made and will take some time. But the importance of the object seems to justify a Preliminary Report.

Mackie's "*olfactory lobes*" are, in my opinion, some matrix at the base of the brain below the furrow *f 1*, and possibly correspond to the trigeminal root. The actual olfactory lobes are not visible, unless they are represented by the somewhat uneven end of part I. They would have been as long as a reptile's if they reached into chamber "*c*," fig. 1.

This is quite possible, for convexity 1 is the *fore-brain*. It appears to have had somewhat curved, narrow, elongated hemispheres. Its breadth in the hinder half is fairly even, its size diminishing very gradually from back to front. It was first thought that the furrow *f 2*, the only interruption of its smooth surface, delimited the mesencephalon from the fore-brain. It was noticed, however, that it fell short of the edge and looked rather splintered. It was then evident that *f 2* has nothing to do with the brain. It is due merely to a rupture in the cranium, which is traceable on the counter-slab and is also continued in the exposed part of the cranium on the principal slab.

The tectum *mesencephali* seems, nevertheless, to have lain, as in reptiles, entirely on the dorsal side of the brain. Comparison with the brain-cast of the Pterosaur *Scaphognathus*, described by Newton (1889), reveals the striking similarity between our part II and the middle brain of that animal. A similar torus is, as there, placed transversally behind the fore-brain and appears broader than it, because it encircles it from the back. The relationship between its external portion and the fore-brain looks, in fact, similar to that of a part of some bird's mid-brain. But neither in *Archæopteryx* nor in *Scaphognathus* could the median part be explored; in the *Scaphognathus* specimen the cast is broken here, and in *Archæopteryx* covered by bone.

It is therefore not known whether the *cerebellum* came between the lobi optici. At all events, part II of the

*Archæopteryx*-brain does not appear to have been overlapped by any considerable portion of brain as the middle brain of modern birds is by the cerebellum, and as it is also the case in the reptile-like brains of Cretaceous birds (Marsh, 1880, 1881-82), and even those of Pterosaurs (according to a skull in the Heidelberg Geological Institute and one in Prof. Watson's collection, London, kindly entrusted to me for description). The question must therefore arise, since *Archæopteryx* is, after all, a bird, whether our part II is not indeed the cerebellum of *Archæopteryx*, with the optic lobes pushed down to the sides and partly below the brain, in bird-like fashion, to a part still covered by bone. But then the remarkable breadth of the "cerebellum" is suspicious, and the posterior edge of part II would have to imply the posterior edge of the cranium. This can only be determined when the preparation is complete. At present it appears that the foramen magnum is probably not adjacent to part II., so that the further parts of the brain (cerebellum and oblongata) may have lain behind.

If this proves to be the case, then we must call the brain of the *Archæopteryx*, with the narrow elongated hemispheres of its fore-brain and its powerful dorsal mesencephalon, a reptile brain.

It has several bird-like characters. It filled its cavum cerebrale completely, whereas in the average reptile, in which meninges and intermeningeal spaces take up more room, the cast of the brain-cavity has not such a definite brain-form; but the Pterosaurian reptiles are also like birds in this respect. The brain axis apparently does not follow the base of the cranium as in lower vertebrates, but forms an angle with it as in birds; but this is also the case in many fossil reptiles.

This view as to the position of the brain within the cranium rests, however, chiefly on the assumption that the skull of the *Archæopteryx* has been imbedded in a similar position in relation to the body as that of the *Archæornis*. The narrow strip of cranium hitherto exposed justifies this supposition. But neither the curve of the brain-stem nor the absolute width of the brain-parts, the nerve-roots, the shape of the cerebellum, the relation of the brain-length to the skull-length, nor other important points of structure can be established with certainty as yet. I hope to be able to communicate more details when the cranium-remains have been fully exposed.

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XVIII.—*The Godman-Thomas Expedition to Peru.*—III. *On Mammals collected by Mr. R. W. Hendee in the Chachapoyas Region of North Peru.* By OLDFIELD THOMAS.

THE mammals enumerated in the present paper were obtained by Mr. Hendee in the region of Chachapoyas, at localities especially important as being places where Mr. Osgood made collections during his journey across Peru.

The collection is considerably richer than the previous one, consisting of 179 specimens belonging to 29 species and subspecies, and containing a number of new and interesting animals which will be of much value for the further study of the Peruvian fauna. Of the four new forms the most striking is the fine Spiny-rat I have named after Mr. Hendee, while its study has also enabled me to discriminate another species of the same group collected by Mr. Rutter on the Ucayale. The new cavy is also an unexpected capture.

In 1924 Mr. Latham Rutter also visited Chachapoyas and Moyobamba, and obtained a number of interesting things, including a new monkey and a new skunk, so that with his collection, that worked out by Mr. Osgood, and what Mr. Hendee has already done, our knowledge of the mammalogy of this part of Peru has much improved, although, of course, a great deal remains to be done in so rich a country.

The actual localities concerned in the present collection are as follows:—

*Condechaca*, Rio Utcubamba, about 15 miles south of Chachapoyas. 7000'. 9th–21st November, 1925.

"A fertile cultivated valley, surrounded by relatively arid hills; besides the animals sent, deer are rather numerous, otter are known, agoutis not uncommon, cats fairly numerous, and I had reports of rabbits."—*R. W. H.*

*Tambo Ventilla*. 8150'. 9th–28th December, 1925.

"A much frequented tambo in a mountain valley near the source of the Huancachaca River, which joins the Utcubamba below Chachapoyas. It is about 10 miles east of Molinopampa, and perhaps 20 from Chachapoyas. The region is one of great humidity and relatively low temperature."—*W. Osgood*.

*Puca Tambo*. 5100'. 31st December, 1925, to 6th February, 1926. About 50 miles east of Chachapoyas.

A few specimens were also obtained at Chachapoyas itself, 7500', and at Molinopampa, somewhat further to the east.

### 1. *Lasiurus borealis*, Müll.

♂. 290. Condechaca, 7000'.

### 2. *Myotis nigricans*, Wied.

♂. 273. Condechaca, 7000'.

♂. 390. Puca Tambo, 5100'.

### 3. *Vampyressa melissa*, sp. n.

♀. 408. Puca Tambo, 7100'.

A large, long-haired, dull-coloured species, with bicuspid median upper incisors and other special dental characters.

Size about as in *V. nymphaea*, but the skull more bulky. Fur thick and soft, hairs of back about 8 mm. in length. General colour above dull brown, the hairs slaty at base, with a dull whitish subterminal band and brown tips; under surface paler brown. Head with the whitish markings present, but less conspicuous than usual, about as in *V. venilla*, far less developed than in *V. nymphaea*. Ears brown, not edged with white. Hind limbs and middle of interfemoral thickly hairy.

Skull in general shape like that of *V. pusilla* and *V. nymphaea*, but more robust. A well-developed sagittal crest in the type. Palate extending back to about the same distance as in *pusilla* and *nymphaea*, but the choanal edge as in *thyone* and *venilla*, sharply angular instead of transverse. Basial concavities deep and sharply defined. Inner upper incisors long, nearly parallel-sided, each with two distinct subequal terminal cusps; outer incisors very small. Other upper teeth as usual, except that the anterior molar is much narrower antero-posteriorly in proportion to its transverse breadth than usual, the lesser diameter hardly more than half the greater. Lower incisors longitudinally grooved. Second lower molar large, its postero-internal cusp very high and more or less gouge-shaped. Behind this tooth, in the type, there is a minute third molar on each side, but this is in all probability an atavism, not likely to be constant.

Dimensions of the type:—

Forearm 37.5 mm.

Head and body 54; ear 16; third finger, metacarpal 35; first phalanx 16; second phalanx 20; lower leg and foot (c. u.) 22.7.

Skull, greatest length 21.5; condylo-basal length 20; zygomatic breadth 13.3; interorbital breadth 5.4; intertemporal breadth 5; mastoid breadth 10.2; palatal length 10.8; front of canine to back of  $m^2$  7.1;  $m^1$ , antero-posterior diameter 1.4, transverse diameter 2.5.

*Hab.* as above.

*Type.* Adult female. B.M. no. 26. 5. 3. 4. Original number 408. Collected 15th January, 1926.

This is a very strongly marked species. Its size, dull coloration, inconspicuous face-markings, angular choanæ, peculiarly shaped  $m^1$ , and the unusual development of the characteristic cusps on  $m^2$ , all readily distinguish it from the other species of the genus. The occurrence of a minute  $m^3$  in the type is probably of no systematic importance.

A small species of the same genus, *V. venilla*, was discovered by Mr. Rutter in the tropical lowlands of Amazonian Peru.

#### 4. *Diphylla ecaudata*, Spix.

♀. 425. Puca Tambo, 5100'.

#### 5. *Felis pajeros*, Desm.

♀. 297. Condechaca.

Purchased of a native, who shot it in a canyon near Condechaca.

Subspecies of the pampas-cat have been described from Cuzco by Matschie as *F. p. garleppi*, and from Pichincha by Lönnberg as *F. p. thomasi*, of the latter of which we have a topotype presented by Consul Söderström. Without further material I can express no opinion as to the relationships of these local races, but the Condechaca specimen is likely to belong to the Cuzco form.

6. *Pseudalopex culpæus andina*, Thos.

♂. 365. Tambo Ventilla, 8150'.

7. *Mustela agilis*, Tsch.

♂. 179. Celendin.

♀. 300. Condechaca, Rio Utcubamba, 7000'.

8. *Sciurus pyrrhinus*, Thos.

♂. 435; ♀. 415, 418. Puca Tambo, 5100'.

9. *Microsciurus peruanus*, Allen.

♀. 436, and a separate skull, 407. Puca Tambo, 5100'.

The type-locality of this species, "Guayabamba," which is probably the place now known as Huayabamba, is in this region, so that the present specimen may be looked upon as a topotype. Our specimens from Chanchamayo, which are the type-series of Allen's *M. rubrirostris*, are certainly very nearly allied to *M. peruanus*, but the differences he mentions, such as they are, are confirmed by Mr. Hendee's example of the latter.

10. *Nectomys apicalis*, Pet.

♀. 313. Molinopampa.

11. *Oryzomys polius*.

♂. 279; ♀. 267. Condechaca, Rio Utcubamba, 7000'.

12. *Oryzomys keaysi*, All.

♂. 395; ♀. 388, 412. Puca Tambo, 5100'.

These specimens, with others in the Museum, vary very considerably in the coloration of the under surface, and one of them, no. 388, is as strongly golden below as the Ecuadorean *O. auriventer*. But this specimen has a very imperfect skull, so that its identity is a little uncertain, and I cannot at



present venture to assert that the gradation from the golden under surface of *auriventer* to the greyish of typical *keaysi* is so complete that these forms will in the end prove to be indistinguishable. The available skulls of these animals are also too few or incomplete to be of material service.

In size there is so much variation as to render a little uncertain the status of *O. levipes*, distinguished from *keaysi* mainly on the basis of inferior size.

13. *Oryzomys albigularis*, Tomes.

♂. 320, 331, 332, 333, 334, 341, 346 ; ♀. 321, 350, 353. Tambo Ventilla, 8150'.

A white chest-spot is almost invariably present.

14. *Oryzomys nitidus*, Thos.

♂. 370, 371, 394, 405, 416, 427, 429 ; ♀. 386, 387, 389, 411, 428. Puca Tambo, 5100'.

15. *Oryzomys minutus*, Tomes.

♂. 263, 268, 275, 292, 301, 395 ; ♀. 261, 276, 277, 287, 288, 291, 394. Condechaca, Rio Utcubamba, 7000'.

♂. 310. Chachapoyas, 7500'.

♂. 314. Molinopampa.

♂. 373, 374, 391, 401 ; ♀. 372, 377, 385, 392, 398. Puca Tambo, 5100'.

The animal usually known as *O. stolzmanni*—*vide* the previous paper.

In view of the great variation in size shown by specimens of this widely-distributed species, I confess to some scepticism as to the distribution of Osgood's *Oryzomys andinus*, separated mainly by having longer feet and tail. For in the present set no. 292 has the hind foot 25 mm. (without claw) and tail 154 mm. in length, as compared with the 26 mm., with claw, and 149 of the type of *andinus*, while its dimensions are led up to by those of other specimens of the same series. The skull-characters given are just those found in very old specimens with worn-down teeth.

16. *Neacomys spinosus*, Thos.

♂. 381. Puca Tambo, 5100'.

17. *Thallomyscus aurillus*, Thos.

♂. 325. Tambo Ventilla, 8150'.

As usual far less often captured than *Oryzomys minutus*.

18. *Rhipidomys modicus*, sp. n.

♀. 368. Puca Tambo, 5100'.

A medium-sized species of dull buffy colour and whitish belly. Size decidedly larger than in the small species of the *latimanus* group and smaller than in *leucodactylus* and its allies. Fur rather short for this genus, hairs of back about 6 mm. in length. Ground-colour above dull buffy, below white, the bases of the hairs slaty; line of demarcation not very sharply defined. Face slightly greyer than back. Ears dull brown, not strongly contrasted. Fore limbs greyish buffy to the metacarpus, digits dull whitish. Hind limbs dull buffy to the ankles, upper side of metatarsus black with a whitish edging along their hallucal edge; digits dark brown, the hairs at the base of each claw white. Tail of medium hairiness, blackish throughout as usual.

Skull of the usual shape, readily distinguishable by its intermediate size.

Dimensions of the type:—

Head and body 131 mm.; tail 176; hind foot 28; ear 18.

Skull: greatest length 35·5; condylo-incisive length 32·2; zygomatic breadth 18·4; nasals 12 × 4·6; interorbital breadth 6·1; palatilar length 14; palatine foramina 7; upper molar series 5·6.

*Hab.* as above.

*Type.* Young adult female. B.M. no. 26.5.3.69. Original number 368. Collected 3rd January, 1926.

This species is readily recognisable by its intermediate size, whitish belly, and prominently black hind feet. It has nothing of the striking belly-colour of Allen's *R. ochrogaster* from the Inambari.

"Trapped in bushes near stream."—*R. W. H.*

19. *Thomasomys aureus*, Tomes.

♂. 362; ♀. 344. Tambo Ventilla, 8150'.

20. *Thomasomys ischyryus*, Osg.

♂. 316, 326, 337, 340, 349; ♀. 322, 328, 330, 339, 345, 359. Tambo Ventilla, 8150'.

These specimens, from one of the two localities mentioned by Mr. Osgood, are more variable *inter se* than the series from Leimabamba mentioned in the previous paper, some of them being of the deepest and richest *ischyryus* colour, strongly cinnamon, and others as grey as in the *T. i. eleusis*

from Tambo Jenes. But, on the whole, they confirm the description of *eleusis* as averaging greyer than *ischyrus*.

21. *Phyllotis andium*, Thos.

♂. 264, 265, 266, 280, 281, 282, 286, 303; ♀. 271.  
Condechaca, Rio Utcubamba, 7000'.

♂. 305, 306, 308, 311. Chachapoyas, 7500'.

♀. 315. Molinopampa.

These specimens represent *P. a. stenops*, Osg.—those from Condechaca being topotypical,—but, as said in the previous paper, I hardly think they should be separated from true *andium*.

22. *Akodon mollis altorum*, Thos.

♂. Puca Tambo, 5100'.

23. *Microxus orophilus*, Osg.

♂. 309. Chachapoyas.

5 ♂, 7 ♀. Condechaca, Rio Utcubamba, 7000'.

5 ♂, 6 ♀. Tambo Ventilla, 8150'.

Some or, perhaps, many of these specimens may be *Akodon mollis altorum*, but for the moment it is not possible to guarantee the determination of every specimen, such is the superficial resemblance of the two forms.

The relation to each other of *Microxus* and *Akodon* in this and other regions is a matter of extreme interest, and I hope I may induce Mr. Hinton, who has paid so much attention to this sort of problem in Old World mammals to undertake a special study in regard to the present case.

24. *Microxus orophilus orientalis*, Osg.

8 ♂, 3 ♀. Puca Tambo, 5100'.

Topotypes.

25. *Mesomys ferrugineus*, Günth.

♀. 414. Puca Tambo, 5100'.

Immature, so that the determination is not very certain. Previous records of the genus have all been in the low-lying regions of the Amazon valley.

26. *Proechimys hendeei*, sp. n.

♂. 366, 419, 420, 421, 426, 432, 434; ♀. 417, 430, 431, 433. Puca Tambo, 5100'.

A black or blackish species, without cinnamon suffusion. Rostrum very slender. Size rather small, form comparatively light. Fur only hispid, not to be called spinous. General colour above uniform blackish brown, without the buffy or cinnamon suffusion so strongly marked in all the species hitherto described. But lighter rings of a dull buffy colour are just perceptible on the hairs, especially those of the sides, but these scarcely affect the unusual sombreness of the general colour. Under surface wholly pure white, sharply defined laterally at a comparatively high level. Whole of head blackish, like body. Fore limbs dark brown on outer surface, white on the digits, inner side of wrist, and lower surface. Hind limbs similarly blackish and white, the feet whitish along their hallucal halves and on the toes. Tail of medium length, thinly haired, with large scales ten to the centimetre, sharply contrasted bicolor, brown above, white below.

Skull narrow and delicately built, with a remarkably narrow muzzle, the nasals much narrower than in other species, less than 4 mm. wide at their middle point, as compared with about 6 in most species of the same size. The frontal processes of the premaxillaries also very narrow, their broadened posterior ends only about 1.5 mm. in breadth. Interorbital region narrow, smooth, its edges not heavily ridged, the supraorbital edge running back as a little developed ridge only about one-third across the parietals. Brain-case comparatively smooth and little ridged. Palatal foramina short but variable. Mesopterygoid fossa rounded in front, where it attains to the level of the middle of  $m^2$ , the penultimate tooth of the series. The fossa itself unusually shallow and widely open, and the hamular processes, which are narrowly spatulate, standing up much less above the surface of the sphenoid. Bullæ rather small and low. Paroccipital processes narrowly pointed, with but little internal flattening. Lower jaw with comparatively short angular process.

Dimensions of the type:—

Head and body 219 mm.; tail 214; hind foot 51.5; ear 26.

Skull: greatest length 58.5; condylo-incisive length 47; zygomatic breadth 26.5; nasals, length 20; greatest anterior breadth 5.5; middle breadth 4.4; interorbital breadth 11.2; breadth of brain-case 21.3; palatilar length 17; palatal foramina  $6.3 \times 3.2$ ; length of bulla 9.2; upper tooth-series 8.

*Hab.* as above.

*Type.* Adult male. B.M. no. 26. 5. 3. 140. Original number 434. Collected 5th February, 1925.

"Trapped under rocks in forest."—*R. W. H.*

This fine black Spiny-rat is remarkably distinct from all species hitherto described. Its scarcely spinous fur, blackish colour, narrow muzzle, and other cranial characters separate it widely from any other species known to me, and it is with great pleasure I name it after its captor, who has shown so much keenness and ability in carrying out this Peruvian exploration.

The excellent series of *P. hendeei* is remarkably uniform in colour, the only variation being a tendency in some specimens to have a dull buffy suffusion on the sides of the back, but the difference amounts to very little. Nor do the skulls show any variation to speak of.

But in working out this animal I have found that another spiny rat, collected by Mr. Latham Rutter on the Ucayale, is allied to it, and shows many of its characters, so that the two seem to form a special group of the genus. This was not perceived before owing to the imperfection of the Ucayale material, but with the knowledge gained from Mr. Hendee's specimens I may now venture to describe it. The material available consists of a young female skin, without skull, and a fully adult female skull. It may be called

*Proechimys rattinus*, sp. n.

Character of pelage about as in *P. hendeei*. Ground-colour as in that species, but the white of the under surface, instead of covering the whole underside up to the flanks, is restricted to the middle area, mainly in two large patches, one sternal and the other inguinal, the blackish of the sides extending all across the throat, and nearly across the middle of the belly, where the white is reduced to a breadth of about half an inch. The delimitation of the brown and the white quite irregular everywhere. Arms dark brown above and below, tips of fingers whitish. Hind limbs blackish brown throughout, the only light hairs being a few silvery ones at the bases of the claws. Tail uniformly blackish above and below, instead of being conspicuously bicolor.

Skull in general characters as in *hendeei*, the nasals similarly slender, but the posterior ends of the premaxillary processes are broader, 2.6 mm. Supraorbital ridges a little heavier, with a greater tendency to a postorbital projection.

Zygomatic shoulders less "flaring," more of the "champagne-bottle" shape. Mesopterygoid fossa only reaching forward to the level of the middle of the last molar, where it is squarely angular. Bullæ a little larger.

Dimensions of the young female skin :—

Head and body 190 mm.; tail 150; hind foot 48; ear 21.

Of the adult female skull, the type :—

Greatest length 56·5; condylo-incisive length 47; zygomatic breadth 26; nasals, length 20·5; greatest anterior breadth 5·5; middle breadth 4·5; interorbital breadth 11·5; breadth of brain-case 21; palatilar length 20; palatal foramina 5·5; length of bulla 10·5; upper tooth-series 8·2.

*Hab.* Ucayale. Type from Tushemo, Masisea, 1000'.

*Type.* Adult female skull without skin. B.M. no. 24. 2. 22. 16. Original number 163. Collected September 1923 by Latham Rutter. Presented by Oldfield Thomas.

Quite young specimens of the ordinary cinnamon or buffy mixed species of *Proechimys*, being commonly more or less blackish, it is not surprising that the *Rattus rattus*-coloured young specimens from Tushemo did not attract attention until the comparison of the adult skull, obtained at the same time and place, with those of *P. hendeei*, showed that here was a second species of the same group, equally distinguishable from all described forms by its blackish general colour and narrow muzzle. But from *hendeei* itself the Ucayale species is readily distinguishable by its uniform non-bicolor blackish tail, black feet, and the contraction of the belly white to a narrow median area, while in the skull the normally broadened premaxillary processes, the champagne-bottle shoulders, and the less projection forward of the meso-pterygoid fossa, will readily distinguish the two species.

The state of age of the skin is such that four-fifths of the animal has normal glossy subspinous fur, like that in adult *hendeei*, while the rump and hind limbs are still covered with the soft fur of youth. No. 433 of *P. hendeei* is in almost exactly the same stage, and gives confidence that one is justified in using the young *P. rattinus* for description and comparison.

"Caught in forest."—*L. R.*

Another young *Proechimys*, probably *P. pachita*, was obtained by Mr. Rutter at the same time and place as *P. rattinus*.

27. *Cavia tschudii stolidus*, subsp. n.

♀. 228. Rio Utcubamba, 8500'.

♂. 361. Tambo Ventilla, 8150'.

A large dark cavy with unusually large and heavy head; the nasals particularly broad.

Size large, form very heavy. General colour uniform dark brown suffused with buffy, the general tone approaching olive-brown; no special darkening on back as is the case in *umbrata*, the tone of the ground-colour also much warmer than in that animal. Under surface dull soiled buffy, most marked on the chest and inguinal region. Head like back, not blackened. Hands and feet grizzled brown, the digits lighter.

Skull quite peculiarly broad and heavy, its breadth much exceeding that of other forms, and the muzzle especially broadened. Compared with that of *C. t. umbrata*, of which, thanks to Mr. Héndec's Junin collection, we now have a good series, the difference in form is conspicuous, the oldest *umbrata*, with well-developed sagittal crest, having the nasals only 8.5 mm. in breadth as compared with 10 in the younger specimen, no. 361, of the new form (no sagittal crest), and 11 in the type (with crest). *Cavia atahualpa*, Osgood, whose type is recorded as an "adult female" has this breadth 8.6, as in *umbrata*. Bullæ as in *umbrata*. Other skull-characters not peculiar, but the teeth are decidedly larger than in the other forms concerned, the alveolar length of the tooth-row 15 in the younger and 17 mm. in the older specimen. Last molar with the supplementary posterior lobe more developed than usual, twice as long as in *umbrata*, and turned inwards to form a definite hook.

Dimensions of the type:—

Head and body 313 mm.; hind foot 49; ear 29.

Skull: upper length 63; condylo-incisive length 59.5; zygomatic breadth 39.3; nasals 22 × 12; frontal process of premaxillary, breadth 2; interorbital breadth, ignoring the lateral notches, 17; breadth of brain-case above squamosals 25.8; palatilar length 29; length of bulla 12; upper tooth-series (crowns) 15.5; length of  $m^3$  including posterior lobe 4.8; breadth of  $m^3$  4.3.

*Hab.* as above. Type from the Rio Utcubamba.

*Type.* Adult female with well-marked sagittal crest. B.M. no. 26. 5. 3. 145. Original number 228. Collected 20th September, 1925.

This fine cavy, which Mr. Osgood heard of at Tambo

Ventilla, but failed to obtain, is no doubt related to the one from Cajamarca which he called *Cavia atahualpæ*, but, while the colour of the two forms would seem to be very much the same, the discrepancy in the skull-measurements is far too great for the present animal to be the same as his. Moreover, the two localities, although not far apart on the map, are on different sides of the Central Cordillera, so that identity is quite unlikely.

The only other form concerned, *C. t. umbrata*, is of a wholly different coloration, dark grizzled grey with blackened back, or even wholly black.

The present represents the furthest north-western extension of the genus *Cavia*, and thus gives welcome help towards a mapping of the Peruvian Fauna.

28. *Sylvilagus capsalis*, Thos.

♂. 190-191. Celendin.

♀. 364. Tambo Ventilla. 8150'.

Type-locality. San Pablo, Cajamarca.

29. *Marmosa* sp.

♂. 413; ♀. 409. Puca Tambo, 5100'.

*M. cinerea* group. Too young for determination.

# BIBLIOGRAPHICAL NOTICE.

*British Birds*. Vol. III. By ARCHIBALD THORBURN. Published by Longmans, Green & Co. Pp. 168 and 47 coloured plates.

In the third volume of his work on British Birds Mr. Thorburn gives us the herons, ducks and geese, the game-birds, crakes, bustards, and waders. Naturally with an author of so great a reputation as an artist, one turns first to the plates in considering the value of the book. Many of these, more especially the beautiful plates of the pigeons, do justice to Mr. Thorburn. Higher praise than this is hardly necessary; on the other hand, others of them appear to us to be not quite up to the very high standard the author has set himself. Some of the plates of ducks are very wooden—as, for instance, that of the pintail, the pochards, and the long-tailed duck. Again, we cannot help feeling that the author in some cases allows his love of brilliant colouring to override his knowledge as a naturalist, and a few of the plates suffer in this respect. Doubtless with most authors we should have been content to say that the plates were beautiful and add nothing more, but Mr. Thorburn must expect a severer criticism than falls to the lot of other painter-authors. The letterpress is, on the whole, to the



point and gives one a brief epitome of how to recognize each species, together with notes on its habits etc. On the other hand, we regret to see that a very old system of nomenclature is still adhered to, and even this is not as correct as it should be. Thus, on p. 145 we see *Egialitis* spelt correctly; on p. 146 as well as in other places it is spelt *Egialites*, whilst on the next page it is spelt *Egialities*. Does Mr. Thorburn imagine the birds referred to belong to three different species, or is this merely artistic licence? With the cheap little hand-list of British birds now issued by the B. O. U. it is a simple matter to keep to a proper nomenclature, and we hope Mr. Thorburn, before the next part comes out, will invest half-a-crown in the list and learn by what scientific names our English birds should be called. We may, perhaps, have seemed rather severe in some of our above remarks, but the whole work is such a beautiful one and so very well worth possessing, that it seems a pity that the few faults it contains, and which are so easily remediable, should not be remedied.

## PROCEEDINGS OF LEARNED SOCIETIES.

### GEOLOGICAL SOCIETY.

April 21st, 1926.—Dr. F. A. Bather, M.A., F.R.S.,  
President, in the Chair.

The following communication was read :—

'*Anthracopupa britannica* sp. nov., a Land Gastropod from the Keele Beds of Northern Worcestershire.' By Leslie Reginald Cox, M.A., F.G.S.

This paper records, for the first time, the occurrence of a Pulmonate Gastropod in British Carboniferous rocks. A few species belonging to the group have long been known from rocks of Upper Devonian and Carboniferous age in North America, but the only previous record from European Palæozoic strata is a single fragmentary specimen from the Lower Permian of France.

The specimens described were collected by Mr. W. Wickham King, F.G.S., in 1924. They were found in a grey calcareous claystone, interstratified with the vermilion marls of the lower part of the Keele Beds, on the northern slope of Clent Hill (Worcestershire).

The shells are about 3 mm. in height; the aperture of one has been developed clearly, and shows a very prominent parietal tooth, as also a more stumpy tooth on the columella. There is no doubt that the species is a land shell, referable to the family Pupillidæ; it is very close to *Anthracopupa vermilionensis* (Bradley), from the Coal Measures of Illinois, but differs in being slightly stouter, and in the much more acute angle between its columellar lip and the anterior apertural margin

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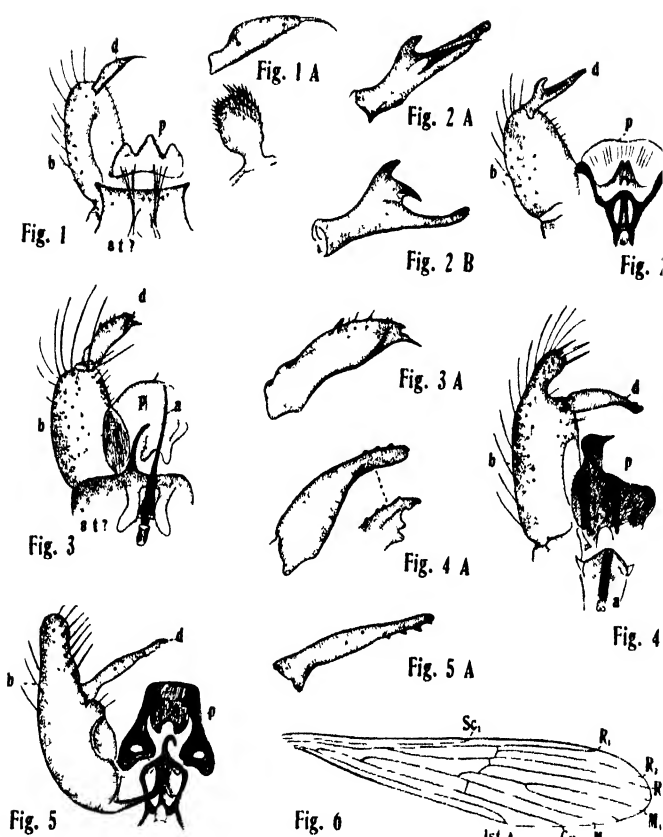
XIX.—*New or little-known Tipulidæ (Diptera).*—XXXII.  
*Australasian Species.* By CHARLES P. ALEXANDER, Ph.D.,  
F.E.S., Massachusetts Agricultural College, Amherst,  
Massachusetts, U.S.A.

THE species considered in the present instalment are from Australia and Tasmania. The majority of the specimens were collected by Dr. A. L. Tonnoir, to whom my sincere thanks are extended for the privilege of examining this splendid series. Other specimens were collected by my friends Messrs. Ferguson, Hardy, and Hill, to all of whom I express my deep thanks for kind co-operation in making known the Australian Tipulid fauna. The Tonnoir material has been returned to Dr. Tonnoir; Dr. Ferguson's specimens will be placed in the Australian Museum; Mr. Hardy's in the collection of the University of Queensland, Brisbane; Mr. Hill's in the National Museum, Victoria.

TASIOCERA, Skuse.

889. *Tasiocera*, Skuse, Proc. Linn. Soc. New South Wales, (2) iv.  
pp. 815, 816.

The genus *Tasiocera* was erected by Skuse to receive two Australian species (*T. tenuicornis*, Skuse, and *T. gracilicornis*, Skuse). In 1920, the writer (Mem. Queensland Mus. vii. p. 1) proposed *tenuicornis* as type. Since this date, six  
*Ann. & Mag. N. Hist. Ser. 9. Vol. xviii. 12*



Male genitalia and wing-venation of Australian species of  
*Tasiocera*, Skuse.

Explanation of symbols:—*Hypopygial*. *a*=ædeagus; *b*=basistyle; *d*=dististyle; *p*=phallosome; 8 *t*?=supposed ninth tergite. *Venational*. *Cu*=Cubitus; 1st *A*=1st Anal; *M*=Media; *R*=Radius; *Sc*=Subcosta.

Fig. 1.—Male hypopygium of *T. unisetosa*, sp. n.

Fig. 1 A.—Dististyle, enlarged; lateral lobe of ninth tergite.

Fig. 2.—Male hypopygium of *T. axillaris*, sp. n.

Figs. 2 A, B.—Different views of dististyle of same, enlarged.

Fig. 3.—Male hypopygium of *T. caudifera*, sp. n.

Fig. 3 A.—Dististyle, enlarged.

Fig. 4.—Male hypopygium of *T. attenuata*, sp. n.

Fig. 4 A.—Dististyle, enlarged; tip of dististyle of another specimen, still more enlarged, to show variation in apical denticles.

Fig. 5.—Male hypopygium of *T. angustistylus*, sp. n.

Fig. 5 A.—Dististyle, enlarged.

Fig. 6.—Wing of *T. angustistylus*.

additional species have been described by the writer from New Zealand and five others are characterized below from New South Wales, Victoria, and Tasmania. The members of the genus seem to be restricted to this general region\*.

Two species described as members of the genus do not seem to belong here. *Tasiocera minutissima*, Edwards (Trans. Linn. Soc. London, Zool. xv. pp. 210-211, 1912), of the Seychelles Islands, is not a true member of the genus, although closely allied thereto in the structure of the male hypopygium, especially the simple dististyles. The structure of the antennæ and the wings is very different, however. The second species, *Tasiocera fragilicornis*, Riedel (Arch. für Naturgeschichte, lxxxii. Abt. A, Heft 5, pp. 112, 113, 1916), was described from Formosa. The writer subsequently examined material of this and found that it was referable to the tribe Hexatomini rather than to the Eriopterini, the genus *Taiwanomyia*, Alexander (Philippine Journ. Sci. xxii. pp. 476-477, 1923), being proposed to receive it.

The genus *Tasiocera* is well characterized by the great length and structure of the male antenna, the cuneiformly narrowed wings with certain venational peculiarities (especially the lack of the anterior arculus, the basal fusion of *Cu* and *M*, and the extreme brevity of vein 2nd *A*), and the structure of the male hypopygium (especially the single dististyles, and the varied structure of the phallosome, which is sometimes asymmetrical).

The exact homologies of the parts of the male hypopygium of *Tasiocera* are still much in doubt, and certain structures are herein interpreted with a question. The various species have a pale fleshy plate that is tentatively homologized as being the ninth tergite. This is not shown in the accompanying figures (except a single lateral lobe or angle in fig. 1 A). Its exact identity must be held in question, as must that of the plate called "8t?" in the figures. More material is needed before the constituent parts of the phallosome can be homologized.

#### *Tasiocera unisetosa*, sp. n.

Size small (wing, ♂, under 3 mm.); general coloration dark brown; vein 2nd *A* extending some distance beyond the origin of *M*; male hypopygium with the dististyle terminal in position, relatively slender, the apex extended into a powerful apical seta.

\* Since the above was written, Mr. Edwards has informed me that he has seen an Oriental species of *Tasiocera*.

*Male*.—Length about 2.2 mm.; wing 2.8 mm.

Antennæ with the flagellar segments elongate-cylindrical, shortened distally, near mid-length of the organ passing into a generally elongate-fusiform structure, the segments shortened to the tip; pedicels of the subterminal segments become longer, but are still shorter than the dilated portions of the segments. Head dark brown.

Thorax uniformly dark brown. Halteres elongate, pale brown, the extreme bases brighter. Legs uniformly dark brown. Wings with a uniform pale brown tinge, the veins and macrotrichiae still darker brown. Venation:  $R_{2+3}$  about equal to or a little shorter than the basal deflection of  $R_{4+5}$ ; second anal vein extending some distance beyond the origin of  $M$ .

Abdomen dark brown, including the hypopygium (fig. 1). What seems to represent the eighth tergite (8t?) broad, the extreme lateral angles produced laterad in small, obtuse, darkened points; caudal margin transverse, ill-delimited, the dorsal surface with sparse elongate setæ. Apices of ninth tergite appear as fleshy lobes that are densely set with strong flattened spines and setæ. Basistyle cylindrical, with long setæ, longest near apex. Dististyle (fig. 1 A) terminal in position, slender, broadest before mid-length, thence narrowed gradually to the apex, which is prolonged into a very powerful curved seta; surface of the style with a few microscopic setæ, mostly subapical in position. Phallosome trilobed.

*Hab.* Tasmania (West).

*Holotype*, ♂, King River, February 4, 1923 (*A. Tonnoir*).

*Tasiocera axillaris*, sp. n.

Male hypopygium with the dististyle terminal in position, ending in three conspicuous points or spines.

*Male*—Length about 2.2–2.3 mm.; wing 3.4–4.2 mm.

Rostrum brownish ochreous; palpi brown. Antennæ more than twice the length of the body, the basal three or four flagellar segments elongate-cylindrical, only a trifle narrowed at apex; remaining segments slightly enlarged basally, the apex produced into a pedicel, this becoming longer and more conspicuous on the subterminal segments, where it nearly equals the dilated portion in length; all segments with conspicuous erect verticils. Head dark greyish brown.

Thorax uniformly dark brown. Halteres pale brown, the

knobs darker. Legs brown. Wings pale brown, the veins slightly darker; macrotrichia dark brown. Venation:  $R_{2+3}$  in alignment with  $Rs$ , about twice the length of the basal deflection of  $R_{4+5}$ ; vein 2nd  $A$  ending a very short distance beyond the origin of  $M$ .

Abdomen brown, the hypopygium testaceous brown. Male hypopygium (fig. 2) with the basistyles relatively stout. Dististyle terminal in position (figs. 2 A, B), produced into three conspicuous points: a slightly curved flattened spine on outer margin before mid-length, with a second, more slender, acute spine in its axil; the main axis of the style is further produced into a long slender rod that is weakly toothed at apex, the distal half with scattered microscopic setulae.

*Hab.* Tasmania.

*Holotype*, ♂, Wilmot, January 8, 1923 (*A. Tonnoir*).

*Paratypes*, ♂, Burnie, January 31, 1923 (*A. Tonnoir*); ♂, Adventure Bay, December 30, 1922 (*A. Tonnoir*).

*Tasiocera caudifera*, sp. n.

*Male*.—Length about 3 mm.; wing 4.8 mm.

Generally similar to *T. gracilicornis*, Skuse, differing conspicuously in the genitalic characters.

Vein 2nd  $A$  ending a short distance before the origin of  $Rs$ .

Male hypopygium (fig. 3) with the dististyle (fig. 3 A) terminal in position, relatively large, flattened, just below the apex extended into a pale flattened blade with a few additional smaller teeth at apex; a small finger-like lobe on outer edge of style near mid-length. The phallosome is very large and developed, appearing as very extensive pale plates across the genital chamber. Aedeagus very long and slender for a member of this genus, nearly straight. What seems to be the eighth tergite (8 $t$ ?) is produced medially into a slender, curved, tail-like projection.

*Hab.* New South Wales.

*Holotype*, ♂, Sydney, August 27, 1922 (*E. W. Ferguson*).

The type is in the writer's collection, other specimens in Dr. Ferguson's material. The fly was sent to me by Dr. Ferguson as *T. gracilicornis*, Skuse, to which species it is most closely allied, differing, however, in the structure of the hypopygium. M. Tonnoir secured the true *gracilicornis* in New South Wales, and the genitalia conform closely to the description and figure given by Skuse.

*Tasiocera attenuata*, sp. n.

Male hypopygium with the dististyle subterminal in position; phallosome heavily chitinized, asymmetrical, the caudal margin resembling the head and beak of a bird.

*Male*.—Length about 2.4–3 mm.; wing 3.8–4.7 mm.

*Female*.—Length about 3.8 mm.; wing about 4.2 mm.

Antennæ (♂) elongate, approximately twice the length of the body; basal segment of flagellum very long, approximately equal to the combined head and thorax; segments beyond the first with short apical pedicels, the segments becoming shorter, with longer pedicels, toward the end of the organ; scapal segments paler than the flagellum. Antennæ (♀) short, not extending to the wing-root; outer flagellar segment oval. Head dark brown, the vertex between the eyes narrow.

Thorax brown, the pleura paler. Halteres elongate, brown. Legs with the coxæ pale brown, the remainder of the legs darker brown. Wings tinged with pale brown, somewhat darker brown adjoining the veins; veins darker brown; macrotrichiae brownish black. Venation:  $R_{2+3}$  nearly twice as long as the basal deflection of  $R_{4+5}$ , in alignment with  $R_s$ ;  $r$  on  $R_2$  about three times its length beyond the origin; vein 2nd  $A$  extending to some distance beyond the origin of  $M$ , lying nearer to the level of the origin of  $R_s$  than to  $M$ .

Abdomen dark brown, the basal sternites paler; male hypopygium large, pale ochreous. Male hypopygium (fig. 4) with the basistyles unusually elongate, the apex slightly produced and constricted immediately beyond the point of insertion of the dististyle, this rounded apex provided with from two to four powerful spinous bristles, together with numerous other smaller ones that extend down the outer face of style. Dististyle (fig. 4 A) slender, narrowed distally, the margin irregularly serrulate. Phallosome asymmetrical, heavily chitinized, and blackened, the apex resembling the head and beak of a bird; disk of phallosome produced into a conspicuous chitinized spine. Aedeagus small, curved.

*Hab.* Tasmania.

*Holotype*, ♂, Strahan, west coast, February 5, 1923 (*A. Tonnoir*).

*Allotopotype*, ♀, February 1924 (*G. H. Hardy*); collector's number 406.

*Paratopotypes*, 1 ♂, 1 ♀, with type; 1 ♂, with the allotype; *paratypes*, 2 ♂ ♂, 1 ♀, Zeehan, west coast, February 7,

1923 (*A. Tonnoir*); 1 ♂, Cradle Valley, north-west, altitude 3500 feet, January 23, 1923 (*A. Tonnoir*); 1 ♂, Adventure Bay, south east, December 28, 1922 (*A. Tonnoir*).

Prof. Hardy's material is in the collection of the University of Queensland. *Tasiocera attenuata* appears to be the commonest and most widely distributed species of the genus in Tasmania. It is easily recognized by the large pale hypopygium, the subterminal dististyle, and the massive asymmetrical phallosome.

*Tasiocera angustistylus*, sp. n.

Male hypopygium with dististyle subterminal, very slender; phallosome symmetrical.

*Male*.—Length about 2·2 mm.; wing 3·5 mm.

*Female*.—Length 1·8–1·9 mm.; wing 3 mm.

Antennæ moderately elongate, in the male with the basal flagellar segment elongate-cylindrical, with scattered erect delicate setæ; the succeeding segments are shorter, more enlarged basally, with short terminal pedicels that become longer toward the end of the organ. In the female the antennæ are a trifle longer than the combined head and thorax, the flagellar segments oval. Head dark brown.

Thorax dark brown, the pleura paler. Halteres elongate, brown. Legs with the coxæ and trochanters pale brown, the remainder of the legs darker brown. Wings (fig. 6) tinged with brown, the veins a little darker; macrotrichia darker brown. Venation:  $R_{2+3}$  about equal to basal deflection of  $R_{4+5}$ ; vein 2nd *A* lies so close to the anal margin as to be indistinguishable in the material at hand.

Male hypopygium (fig. 5) with the basistyles unusually elongate, each produced caudad beyond the level of insertion of the dististyle into a stout obtuse lobe that is provided along mesal face with a series of powerful spinous setæ. Dististyle (fig. 5 A) subterminal in position, placed on mesal face of basistyle near mid-length, very slender, narrowed to the slightly curved, weakly toothed apex; ventral margin of style on distal half with two or three separated denticles. Phallosome symmetrical, complicated in structure. *Ædeagus* relatively small, curved.

*Hab.* New South Wales, Victoria, Tasmania.

*Holotype*, ♂, Eaglehawk Neck, Tasman Peninsula, Tasmania, November 22, 1922 (*A. Tonnoir*).

*Allotype*, ♀, Narara, New South Wales, November 3, 1921 (*A. Tonnoir*).

*Paratopotype*, 1 ♂, with type; *paratypes*, 2 ♂♂, with



allotype; 2 ♂♂, 1 ♀, Sassafras, Mt. Dandenong, Victoria, October 20-21, 1922 (*A. Tonnoir*).

CRYPTOLABIS, Osten-Sacken.

1859. *Cryptolabis*, Osten-Sacken, Proc. Acad. Nat. Sci. Philadelphia, p. 224 (1859).

This curious and isolated genus was erected by Osten-Sacken for the reception of *C. paradoxa*, Osten-Sacken, of North-eastern North America. Later, the genus was found to occur in Western North America and to be more abundantly represented in number of species in tropical and temperate South America. Up to the present time, *Cryptolabis* has been found only in the New World, where it is represented by six known species, four in the typical subgenus, with abundant macrotrichiae in the distal cells of the wing (*bisinuata*, Doane, *paradoxa*, Osten-Sacken, *sepulchralis*, Alexander, and *tropicalis*, Alexander), and two in *Pro-cryptolabis*, Alexander, with the cells of the wing glabrous (*argentinensis*, Alexander, and *tenuicincta*, Alexander). It is therefore a matter of great interest and importance to add the genus to the Australasian fauna. M. Tonnoir discovered two species in New South Wales and Tasmania.

The nearest affinities of the genus seem to be with *Tasiocera*, Skuse, but there is a profound gap between the two genera. The structure of the male hypopygium is of a very peculiar nature. There is but a single dististyle, which is small and simple, placed at the apex of the basistyle. The phallosome is a stout, heavily chitinized, sinuous or convoluted tube extending far back into the body, in the extreme cases covering three abdominal segments. The caudal end terminates in an acute point, the cephalic end usually with two flattened rods. This structure is shortest in the genotype. In the Australian species there lies between the dististyles a median, heavily chitinized structure that seems to have no counterpart in the genotype and which appears to be a tergal structure, and is here tentatively designated as such. The ovipositor is fleshy, the valves being very small and blunt. The eggs are very large, relatively few in number, and with a heavy black chorion.

The two Australian species described at this time are closely allied, but readily separable by the structure of the male hypopygium. The species are most closely allied to the Paraguayan *C. sepulchralis*, Alexander.

*Cryptolabis tonnoiri*, sp. n.

General coloration of præscutum reddish brown, the

postnotum with a large obscure yellow mark on the suture; wings with macrotrichiæ extensively developed, including cell *M*; male hypopygium with the dististyle terminating in a slender straight spine; median tergal structure a broad black spine.

*Male*.—Length about 3.2 mm.; wing 4 mm.

Rostrum and palpi dark brown. Antennæ of moderate

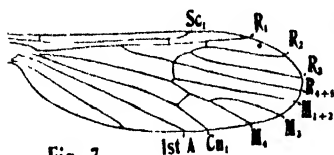


Fig. 7



Fig. 8

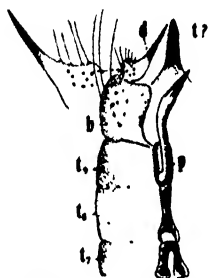


Fig. 9

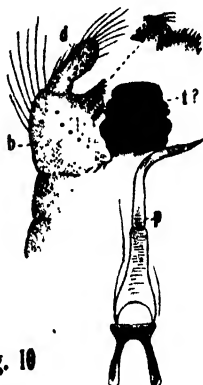


Fig. 10

Wing-venation and male genitalia of Australian species of *Cryptolabis*, Osten-Sacken.

Explanation of symbols:—*Hypopygial*. *b*=basistyle; *d*=dististyle; *p*=phallosome; *t?*=doubtful tergal structure. *Venational*. *Cu*=cubitus; *1st A*=1st Anal; *M*=Media; *R*=Radius; *Sc*=Subcosta.

Fig. 7.—Wing of *C. tonnoiri*, sp. n.

Fig. 8.—Wing of hypopygium of *C. tasmanica*, sp. n.

Fig. 9.—Male hypopygium of *C. tonnoiri*, sp. n.

Fig. 10.—Male hypopygium of *C. tasmanica*, sp. n.

length, if bent backward extending about to the wing-root, dark brown throughout; second scapal segment enlarged; flagellar segments oval, the more basal ones shorter, the segments with relatively long dark verticils. Head light brown.

Pronotum light yellow, the broad lateral pretergites concolorous. Mesonotal præscutum light reddish brown, the

humeral region brighter, darker antero-medially; scutum dark brown; scutellum more testaceous medially; postnotum dark with a conspicuous yellow mark occupying the antero-lateral portion of the mediotergite and the anterior portion of the pleurotergite. Pleura dark brown, the dorso-pleural membrane paler. Halteres pale yellow, the knobs large, the distal half of the stem infuscated. Legs with the coxæ yellowish testaceous, the fore coxæ darker; trochanters yellow; femora and tibiae yellow, their tips narrowly infuscated; tarsi yellowish testaceous, the segments gradually passing into brown; segments of legs with long erect setæ. Wings (fig. 7) with a faint brownish tinge, the stigmal region vaguely darkened; anal angle infuscated; a vague ill-defined clouding along the cord; veins brown, darker brown along the cord. Numerous macrotrichiae in all the cells of the wing, except *Sc* and the basal portions of *R*, 1st *R*<sub>1</sub>, and *M*. Venation: *Sc*<sub>1</sub> ending opposite the fork of *R*<sub>2+3</sub>, *Sc*<sub>2</sub> opposite the fork of *Rs*, the latter in alignment with *R*<sub>4+5</sub>; *m-cu* near mid-length of *M*<sub>3+4</sub>, the petiole of cell *M*<sub>3</sub> a little longer than *m-cu*.

Abdomen brown, including the hypopygium. Male hypopygium (fig. 9) with the basistyles stout, their bases nearly glabrous, the outer lateral portions with setæ that become long and conspicuous near the outer lateral angles. Dististyle (*d*) fleshy at base, the apex produced into a slender, straight, black spine, the tip acute. From between the styli juts a powerful median spine, whose homologies cannot be stated, but which may represent the tergite (*t*?). The phallosome (*p*) is a stout, sinuous, or slightly convoluted blackened tube that extends back into the abdomen to the seventh segment, the apex terminating into a long acute spine, the base with two bars that are broadly expanded at tips, the notch between very deep and narrowly U-shaped.

*Hab.* New South Wales.

*Holotype*, ♂, Narara, November 3, 1921 (*A. Tonnoir*).

This interesting fly is named in honour of the collector, Dr. A. L. Tonnoir.

*Cryptolabis tasmanica*, sp. n.

General coloration of præscutum dark brown, including the postnotum; sternopleurite with an obscure yellow marking; wings with relatively sparse macrotrichiae, cell *M* and bases of cells *R*<sub>1</sub>, *R*<sub>5</sub>, and *Cu* without them; male hypopygium with the dististyles entirely fleshy; median

tergal structure massive, subquadrate, the caudal margin truncate and microscopically serrulate.

*Male*.—Length 2·8–3 mm.; wing 4·2 mm.

*Female*.—Length 3·8–4·2 mm.; wing 5–6 mm.

Rostrum and palpi brown. Antennæ short, dark brown throughout, if bent backward not attaining the wing-root; flagellar segments oval. Head light brown.

Pronotum light yellow, the median area a little infuscated. Lateral pretergites clear light yellow. Mesonotal præscutum with three approximated or confluent dark brown stripes, the humeral region and lateral margins rather broadly and conspicuously paler brown; scutal lobes dark brown, paler behind, the median area pale; scutellum yellowish testaceous; postnotum dark brown. Thoracic dorsum with rather abundant short yellow setæ. Pleura dark brown, sparsely grey pruinose; sternopleurite with a large pale dorsal marking; dorso-pleural membrane pale. Halteres pale. Legs with the coxæ dark brown, the middle coxæ paler; trochanters obscure yellow; femora yellowish testaceous, the tips infuscated, more extensively so on the fore femora; tibiæ brownish testaceous, the tips narrowly darkened; tarsi passing into brown; setæ of legs less conspicuous than in *C. tonnoiri*. Wings (fig. 8) with a faint darker tinge, the anal angle still more infuscated; veins light brown. Macrotrichiæ not so extensive as in *C. tonnoiri*, cell *M* and the broad bases of cells *R*, *R*<sub>5</sub>, *M*<sub>2</sub>, *M*<sub>4</sub>, *Cu*, and 1st *A* being glabrous. Venation: *m-cu* less than its length beyond the fork of *M*.

Abdomen dark brown, the hypopygium and ovipositor paler. Male hypopygium (fig. 10) very different in structure from *C. tonnoiri*. Dististyle (*d*) entirely fleshy, not at all produced into a spine, provided with conspicuous setæ that are larger and more striking at the apex. Basistyle (*b*) very broad, the mesal apical angle with two dense groups of setæ. The spinous structure in *tonnoiri* that was suggested as possibly being tergal is here represented by a massive, roughly quadrate structure (*t*?), the caudal margin truncated and microscopically serrulate. The phallosome (*p*) is less elongate, more bulbous at base, the apex not conspicuously blackened, the basal bars slender and widely divergent.

*Hab.* Tasmania.

*Holotype*, ♂, Burnie, January 31, 1923 (*A. Tonnoir*).

*Allotype*, ♀, Geeveston, December 7, 1922 (*A. Tonnoir*).

*Paratopotypes*, 1 ♂, 1 ♀; *paratype*, ♀, Wilmot, January 8, 1923 (*A. Tonnoir*).

*Amphineurus (Amphineurus) flavoscutellatus*, sp. n.

General coloration greyish brown, the præscutum with the lateral margins broadly whitish, narrowly margined internally with dark brown; scutellum yellow; pleura whitish with two conspicuous dark brown stripes; antennæ yellow; tips of femora broadly yellow.

*Male*.—Length 3·5–3·6 mm.; wing 5–5·2 mm.

*Female*.—Length 4·3 mm.; wing 5·8 mm.

Rostrum and palpi dark brown. Antennæ short, clear yellow, the terminal segments of the flagellum somewhat darker; flagellar segments oval with black verticils. Head greyish brown, the orbits narrowly clearer grey.

Pronotum pale, the lateral margins dark brown. Mesonotal præscutum reddish brown, sparsely pruinose behind; humeral region and lateral margins broadly whitish, narrowly margined internally by a brownish-black line; scutum light brown, the broad median area more greyish, the posterior callosities of the scutal lobes in some cases conspicuously sulphur-yellow; scutellum yellow; postnotum dark brown, a little more reddish behind. Pleura pale yellow or white, with two conspicuous dark brown longitudinal stripes, one dorsal, including the propleura and the dorsal mesopleurites, passing above the root of the halteres, the second stripe including the sternopleurite and the meron, the pale stripe between broad, silvery grey. Halteres brown, the base of the stem ochreous, the knobs conspicuously light yellow. Legs with the coxæ light brownish testaceous, the bases narrowly infuscated; trochanters light yellow; femora pale with dark setæ, the tips broadly and conspicuously light yellow; tibiæ and tarsi dark brown. Wings with a brown tinge, the costa and stigmal region more yellowish, the latter bordered posteriorly with darker brown; veins *Cu*<sub>1</sub> and *2nd A* more clouded with dusky; vague paler areas beyond the cord in the medial field and in the ends of veins *Cu* and *1st A*; veins dark brown, the macrotrichiæ still darker. In fresh unrubbed specimens the wing is variegated with yellow and black macrotrichiæ, the ground-colour being yellowish with black patches, especially evident in the costal region and following vein *2nd A*; the cells beyond the cord have small nebulous darker areas. Venation: *Rs* only gently arcuated at origin; *m-cu* immediately before the fork of *M*.

Abdomen reddish brown above, the lateral margins of the tergites conspicuously velvety-black; sternites ochreous yellow; hypopygium brownish testaceous. Male hypopygium with the ninth tergite narrowed apically, the caudal

margin with a V-shaped notch, the lobes formed rounded and set with microscopic spicules. Ventral lobe of basistyle very long and slender, extending caudad beyond the other elements of the hypopygium. Two of the three dististyles are long needle-like rods, one straight, the other longer, curved to the narrowly flattened apex. The third dististyle is a short flattened blade. Phallosome very flattened.

*Hab.* Victoria.

*Holotype*, ♂, Fern-tree Gully, Mt. Dandenong, February 22, 1924 (G. F. Hill).

*Allotopotype*, ♀.

*Paratopotypes*, 2 ♂ ♂.

Types in the collection of the National Museum, Victoria.

*Erioptera amabilis*, sp. n.

Anterior mesonotum ochreous-yellow, the posterior sclerites dark brown; pleura with a conspicuous brown longitudinal stripe; femora extensively blackened; wings with a heavy brown pattern that is in part cross-banded; male hypopygium with the ninth tergite broad, the margin divided into three regions, demarked by two powerful spinous setæ.

*Male*.—Length about 3.5 mm.; wing 5 mm.

Rostrum and palpi dark brown. Antennæ pale yellowish brown, of moderate length, the flagellar segments fusiform, each with a central verticil of erect silvery hairs. Head pale buffy, the vertex between the eyes of moderate width.

Dorsum of pronotum pale brown. Mesonotal præscutum and scutum bright ochreous-yellow, unmarked; scutellum brown with a median pale line; postnotal mediotergite dark brown, paler posteriorly. Pleura traversed by a broad dorso-longitudinal dark brown stripe that extends from the propleura, broadening behind to include the entire postnotal pleurotergite; ventral pleurites and sternites pale yellowish testaceous, the meron a little infuscated. Halteres black, the extreme base of the stem pale yellow. Legs with the coxæ and trochanters pale yellowish testaceous; femora black, the bases extensively pale, narrowest on fore legs where less than the basal third is included, broadest on the posterior legs where about the basal half is pale; tibiæ brownish yellow, the tips darker, most conspicuously and extensively so on the fore tibia; mid-tibiæ with a sub-basal area of black hairs; posterior tibiæ with only the extreme tip narrowly infuscated; tarsi yellow, the terminal two segments dark brown. Wings subhyaline, the base and costal region and a seam between the branches of Cu pale yellow; wing-membrane conspicuously

and extensively clouded with brown, this appearing as irregular fasciæ, as follows: at arculus; a Y-shaped cross-band includes the cord as the stem and distal arm, the proximal arm at or near the outer ends of cell *R* and 1st *R*<sub>1</sub>; a narrow but complete fascia crosses the wing at about mid-distance between the cord and wing-tip; small brown marginal spots at ends of all longitudinal veins, larger on the cubital and anal veins; a small brown cloud at fork of *M*<sub>3+4</sub> and another beyond mid-length of vein 2nd *A*; the general effect produced is thus of a relatively heavy cross-banded pattern; veins pale, darker in the infuscated areas; trichiæ long and black. Venation: *R*<sub>2+3</sub> short; *M*<sub>3+4</sub> about equal to *m-cu*; vein 2nd *A* moderately sinuous, about intermediate between the conditions found in *Erioptera* and *Ilisia*.

Abdomen uniformly dark brown, including the hypopygium, the styli a little paler. Male hypopygium with the ninth tergite very broad, the caudal margin divided into three regions, separated from one another by a powerful, gently curved, marginal seta, the lateral regions forming broad diverging lobes, the broader median area low and indistinctly trilobed. Basistyle produced into a long pale ventral lobe and a shorter darkened dorsal lobe. Dististyles two, the more ventral one pale, deeply divided to appear somewhat like a tuning-fork, the second distinctly blackened. Phallosome asymmetrical, the apparent gonapophysis single, narrowed into a slender, gently curved, sparsely setiferous apical horn.

*Hab.* New South Wales.

*Holotype*, ♂, Mt. Wilson, Blue Mts., November 19, 1921 (*A. Tonnoir*).

*Erioptera delectabilis*, sp. n.

*Male*.—Length about 3.5 mm.; wing 5 mm.

Generally similar to *E. amabilis*, sp. n., differing in the coloration of the wings and legs and in the details of structure of the male hypopygium.

Legs with the dark colour much more restricted, the femoral tips being rather narrowly dark brown, this colour including less than the apical quarter, the amount a trifle greater on the fore femora; bases of the femora, especially the middle pair, with dusky setæ to produce a faint infuscation on more than the basal half; fore tibæ rather extensively infuscated, this including about the distal fourth; tarsi pale, the terminal two segments abruptly

blackened; fore legs elongate, the tibiæ a trifle longer than the femora, the tarsi much longer than the tibiæ; basitarsus about one-third longer than the remainder of tarsi taken together; middle tarsi short, the basitarsus shorter than the remainder of the tarsi; posterior tarsi shorter than the tibiæ. Wings with the pattern much more restricted than in *amabilis*, the brown pattern being confined to spots and narrow broken cross-bands, the latter continuous only along the cord. Male hypopygium much as in *amabilis*, the tergite very distinct, broad, large; the median area with a small obtuse triangular lobe, the caudal margin of tergite without setæ.

*Hab.* Victoria.

*Holotype*, ♂, Sassafras, Mt. Dandenong, October 19, 1922 (*A. Tonnoir*).

*Paratopotypes*, 2 ♂♂, October 21, 1922.

*Erioptera (Erioptera) funesta*, sp. n.

General coloration dark brown, including the head and rostrum; præscutum with three delicate brown lines on anterior half, the lateral margins of the sclerite paler; pleura dark, with a paler stripe on the sternopleurite; knobs of halteres dark; wings relatively narrow; vein *2nd A* strongly sinuous, especially apically.

*Female*.—Length about 4 mm.; wing 5 mm.

Rostrum and palpi dark brown. Antennal scape dark brown; flagellum broken. Head dark brown.

Pronotum dark, the posterior notum slightly obscure brownish yellow. Mesonotal præscutum dark brown, the lateral margin fading into brownish yellow; viewed dorsally there is a distinct darker brown line on either side of the broad median area, this line extending caudad to the level of pseudosutural foveæ; a fainter and even narrower median brown line passes between the approximated tuberculate pits; scutal lobes concolorous with the præscutum, the median area pale; scutellum dark brown, shiny; postnotum dark brown, grey pruinose. Pleura dark brownish grey with a broad paler longitudinal stripe on the dorsal portion of the sternopleurite; dorso-pleural membrane dark. Halteres pale, the knobs infuscated. Legs with the coxæ and trochanters brownish testaceous; remainder of legs broken. Wings relatively narrow, especially the basal half, with a pale brown tinge; veins darker brown; macrotrichiæ short, still darker. Venation:  $R_{2+3}$  long, approximately three times the basal deflection of  $R_{4+5}$ ; *m-cu* a short distance



before the fork of *M*; distal section of *Cu*<sub>1</sub> nearly straight, the tips only vaguely deflected; apical sinuation of vein 2nd *A* longer than in *E. simulans*, n. n.; all apical forks deep.

Abdomen dark brown, with yellow setæ. Ovipositor with the valves horn-coloured; tergal valves stout, relatively broad, strongly upcurved to the acute tips.

*Hab.* Tasmania.

*Holotype*, ♀, Eaglehawk Neck, Tasman Peninsula, November 22, 1922 (*A. Tonnoir*).

*Erioptera (Erioptera) simulans*, n. n.

New name for *Erioptera ochracea*, Skuse, Proc. Linn. Soc. New South Wales, (2) iv. p. 819 (1889), nec *E. ochracea*, Meigen, Syst. Besch. i. p. 114 (1818).

I am greatly indebted to Dr. Ferguson for a male of this species (Sydney, December 16, 1923, Ferguson coll.). *M. Tonnoir* secured a female at Narara, November 3, 1921.

The male hypopygium is very different in structure from that of *E. lucerna*, sp. n. Dististyles terminal in position, the outer with conspicuous black microscopic serrulations and spines before the acute apex; inner style a conspicuous flattened blade, the apex bent at a right angle into a long slender point. Outer gonapophyses appearing as suboval pale blades, each with a carina back from the apex.

*Erioptera (Erioptera) lucerna*, sp. n.

General coloration ochreous, including the rostrum; head dark brown, the vertical tubercle yellowish; mesonotal præscutum with three brown stripes; knobs of halteres infuscated; male hypopygium with the dististyles sub-terminal in position.

*Male*.—Length about 4 mm.; wing about 5 mm.

Rostrum ochreous; palpi dark brown. Antennæ with the scapal segments somewhat enlarged, ochreous; flagellar segments dark brown; flagellum broken beyond the base. Head dark brown, the vertical tubercle yellowish.

Pronotum light brown, the lateral pretergites pale. Mesonotal præscutum ochreous, with three distinct brown stripes, the median stripe broader, not reaching the suture; lateral stripes short, crossing the suture on to the scutal lobes; scutellum brownish testaceous, paler caudally; post-notum pale, the sides of the medio-tergite somewhat darkened, pruinose. Pleura largely ochreous. Halteres

pale, the knobs infuscated. Legs with the coxæ and trochanters yellowish testaceous; remainder of legs brownish yellow, the terminal tarsal segments passing into brown. Wings with a brownish-yellow tinge, veins and macrotrichiæ dark brown, the veins with long conspicuous macrotrichiæ. Venation:  $r$  on  $R_2$  about its own length beyond origin;  $m-cu$  some distance before the fork of  $M$ , this about equal to  $r-m$ ; vein  $Cu_1$  with the distal section approximately straight; vein 2nd  $A$  strongly sinuous, especially the distal third.

Abdomen brown, including the hypopygium. Male hypopygium with the basistyles produced considerably beyond the level of insertion of the dististyles into an elongate, conical, setiferous lobe. Mesal face of basistyle with two conspicuous short spines from enlarged bases, the more basal spine considerably larger than the distal one. Dististyles two, the outer one pale, dilated at apex into a triangular head that is slightly split, the tip obtuse. Inner dististyle lying close to the other, a pale, slender, simple rod. Gonapophyses very large, chitinated, arcuated, slightly dilated into narrow blades before the acute tips. Inner gonapophysis a deeply bifurcated pale plate.

*Hab.* Queensland.

*Holotype*, ♂, Burpengary, July 1919.

*Gonomyia (Lipophleps) fuscohalterata*, sp. n.

Rostrum black; antennæ black throughout; head brown and yellow; scutellum yellowish brown; thoracic pleura brown, with a broad whitish-yellow longitudinal stripe; halteres long, dark brown, the knobs a trifle paler; wings with a pale brown tinge, the stigma scarcely darker;  $Sc$  long; abdominal tergites uniformly dark brown.

*Female*.—Length about 4.5 mm.; wing 5 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments elongate-oval, the basal segments longer and thicker, the terminal segments very slender; verticils of moderate length only. Head brown, the anterior vertex and the occiput conspicuously light yellow, separated by a dusky spot on the disk of the vertex.

Pronotum and lateral pretergites conspicuously light yellow, the latter vaguely darkened beyond the pseudosutural foveæ, the tegular region similarly light yellow. Mesonotum dark brown, the pseudosutural foveæ shiny brownish black, the extreme lateral margins of the præscutum a little paler; scutum dark brown, the posterior lateral angles of the lobes

obscure yellow; scutellum yellowish brown; postnotum dark brown. Pleura dark brown with a broad pale yellow longitudinal stripe extending from behind the fore coxæ to the base of the abdomen, passing beneath the base of the halteres, the stripe slightly whitish pruinose. Halteres elongate, dark brown, the knobs with a vague yellow tinge. Legs with the coxæ and trochanters brown; femora light brown; tibiæ brown, the tarsi conspicuously pale yellowish brown, only the two terminal segments dark brown. Wings with a pale brown tinge, the stigma scarcely darker; veins darker brown. Venation:  $Sc_1$  ending about opposite one-third the length of  $R_s$ ,  $Sc_2$  at about one-third of the distance beyond the origin of  $R_s$ ; cell  $R_3$  strongly widened outwardly; cell 1st  $M_2$  strongly narrowed at base;  $m-cu$  shortly before the fork of  $M$ .

Abdominal tergites dark brown, the sternites somewhat paler brown. Ovipositor with the valves long and slender, the tergal valves gently upcurved; basal shield and bases of valves darkened.

*Hab.* New South Wales.

*Holotype*, ♀, Mt. Wilson, Blue Mts., November 19, 1921 (*A. Tonnoir*).

*Rhabdomastix minima*, sp. n.

General coloration dark brown; legs pale brownish testaceous, including the tarsi; wings with a pale brown tinge; cell 1st  $M_2$  narrowed, the outer end pointed,  $m$  being much longer than the outer deflection of  $M_3$ ; macrotrichia of veins relatively sparse.

*Female*.—Length about 2.6 mm.; wing 3 mm.

Rostrum and palpi dark brown. Antennæ moderately elongate, if bent backward extending to the wing-root or just beyond, dark brown, the flagellar segments elongate-oval. Head brown.

Pronotum and mesonotum dark brown. Pleura concolorous, the pleurotergite paler. Halteres broken beyond the dark bases. Legs with the coxæ and trochanters yellowish testaceous, the fore coxæ darker; remainder of legs pale brownish testaceous, only the terminal tarsal segments darker; the longer posterior legs are more infuscated, including the tarsi. Wings with a pale brown tinge, the veins darker brown; stigma oval, darker brown than the ground-colour. Macrotrichia relatively sparse, none on  $R_s$ ,  $R_{s+3}$ ,  $R_2$ , or  $R_3$ ; a scattered series on  $R_{4+5}$  about to the origin; others on outer half of distal sections of  $M_{1+2}$  and

$M_3$ ; no trichiæ on  $M$ ,  $M_4$ ,  $Cu$ , or the anal veins. Venation:  $Sc$  of moderate length,  $Sc_1$  ending just before mid-length of  $R_s$ ; cell 1st  $M_2$  relatively long and narrow, the outer end pointed,  $m$  being much longer than the outer deflection of  $M_3$ ;  $m-cu$  from one-third to one-half its length beyond the fork of  $M$ ; vein 2nd  $A$  gently sinuous.

Abdomen dark brown, the ovipositor brownish horn-colour, the bases of the valves blackened; tergal valves of ovipositor nearly straight, deep, the tips acute.

*Hab.* New South Wales.

*Holotype*, ♀, Waterfall, November 1921 (*A. Tonnoir*).

*Rhabdomastix minima* is much smaller than the genotype, *R. osten-sackeni*, Skuse, differing, moreover, in the coloration of the tarsal segments, the wing-venation, and the number and arrangement of the macrotrichiæ on the wing-veins. The fly that was described by the writer as *Rhabdomastix generosa* (Records South Australian Museum, ii. p. 238 (1922)), based on a legless female, has since been received in small numbers and proves to be more correctly referable to *Ischnothrix*, Bigot.

*Ceratocheilus tasmaniensis*, sp. n.

Mesonotal præscutum reddish brown, the lateral margins broadly light grey, the disk with three conspicuous brown stripes that do not tend to become confluent; halteres yellow; wings with a pale brown tinge; vein  $R_{2+3}$  with about fifteen macrotrichiæ; vein  $M_4$  with a central group of about six macrotrichiæ; abdomen bicolorous.

*Male*.—Length (excluding rostrum) 6.5 mm.; wing 6.3 mm.; rostrum 6 mm.

Rostrum only a little shorter than the body, brownish black throughout. Antennæ brownish black, the scapal segments paler. Head grey, darker on the vertex, the anterior vertex and orbits paler grey; corniculus depressed. Vertex between the eyes about equal in diameter to the second scapal segment.

Mesonotal præscutum reddish brown, the lateral margins broadly light grey, the disk with three conspicuous dark brown stripes, the median stripe broader; the stripes all widely separated, the lateral stripes being straight and not at all incurved toward the median line; scutal lobes dark brown, the median area grey in front, infuscated behind; scutellum brown, broadly reddish brown behind, the surface sparsely pruinose; postnotum dark, the margins of the mediotergite more reddish. Pleura dark brown with a

narrow pale longitudinal stripe occupying the dorsal portion of the sternopleurite, passing caudad to beneath the halteres. Halteres yellow, the knobs scarcely darkened. Legs with the fore and middle coxæ more or less infuscated basally, the posterior coxæ more uniformly testaceous; trochanters yellowish testaceous; femora brown, paler basally; tibiæ and tarsi brownish black. Wings not so strongly tinged with brown as in *C. australasiæ*, Alex., the cord and outer end of cell 1st  $M_2$  vaguely but broadly seamed with darker. Macrotrichiæ: vein  $R_{2+3}$  with about fifteen (in *australasiæ* about five);  $M_4$  with a central group of about six (*australasiæ* with more than twenty-five setæ, some paired, and distributed the entire length of vein). Venation:  $Sc_2$  some distance before origin of  $Rs$ ,  $Sc_1$  a short distance beyond this origin.

Abdominal tergites distinctly bicolorous, the caudal margins broadly, the lateral margins more narrowly infuscated, the disk obscure brownish yellow; seventh tergite uniformly infuscated; eighth and ninth tergites obscure brownish yellow, the hypopygium dark brown; sternites almost like tergites.

*Hab.* Tasmania.

*Holotype*, ♂, Strahan, February 5, 1923 (*A. Tonnoir*).

The only regional species with which this fly may be confused is *C. australasiæ*, Alexander (Lord Howe Island). The two species are separable by the diagnostic characters given above.

### *Orimarga joana*, sp. n.

General coloration yellowish ochreous, the postnotum and pleura dark brown, the latter with two longitudinal silvery stripes; legs yellow, the tips of the femora and tibiæ abruptly blackened; wings yellow with a dusky wash extending the whole length of the wing at near mid-width; cross-veins and deflections of veins with conspicuous dark brown seams; last section of  $M$ ,  $M_{3+4}$ , and  $M_4$  all approximately equal in length.

*Female*.—Length about 7.5 mm.; wing 6 mm.

Rostrum relatively elongate, a little shorter than the head, ochreous; palpi brownish black. Antennæ with basal segment of scape pale brown, the second segment and basal half of flagellum dark brown, the distal half of the flagellum fading into yellow; flagellar segments oval. Head brownish yellow.

Mesonotal præscutum light yellowish ochreous, the sub-lateral region infuscated, the lateral margin narrowly paler; scutal lobes and scutellum ochreous, the central region weakly infuscated; postnotum dark brown. Pleura dark brown with two conspicuous longitudinal silvery stripes, the shorter one dorsal in position, extending to just beneath the tegulæ; the longer ventral stripe extends from the fore coxæ to the base of abdomen, passing beneath the halteres; the dark stripe separating these silvery areas about as wide as the dorsal stripe. Halteres pale yellow, the knobs vaguely darkened. Legs with the coxæ yellow, the bases broadly dark brown; trochanters yellow, remainder of legs pale whitish yellow, the tips of the femora broadly and abruptly blackened; extreme base of tibia black, the tips abruptly blackened; tarsi yellow, the terminal segments passing into brown. Wings with a light yellow tinge, brighter at the base and along the costal margin, with conspicuous brown spots, grey clouds, and a longitudinal dusky wash at about mid-width of the wing, extending from the anal angle to the wing-tip; the brown markings include the arculus; origin of  $R_s$  (largest),  $Sc_2$ , a large oval stigmal area at  $r$ , and smaller clouds at tip of  $R_{2+3}$  and on the vertical basal deflection of  $R_{4+5}$ ; somewhat paler clouds on  $r-m$ ,  $m-cu$ , the fork of  $M$  and of  $M_{3+4}$ ; tiny darkened areas, appearing chiefly as discolorations of the vein-tips, on all the marginal longitudinal veins. Venation:  $Sc_1$  ending shortly before mid-length of the long arcuated sector,  $Sc_2$  not far from its tip;  $r$  at tip of  $R_1$ , placed only about its own length beyond the fork of  $R_s$ ; basal section of  $R_{1+5}$  angulated and weakly spurred at origin;  $r-m$  placed near mid-length of the long distal section of  $R_{4+5}$  and far beyond the other transverse elements of the wing;  $m-cu$  about opposite  $Sc_2$ , oblique; the last section of  $M$ ,  $M_{3+4}$ , and  $M_4$  all approximately equal in length.

Abdomen elongate, as in the group; tergites reddish yellow, the caudal margins of the segments narrowly infuscated; sternites more infuscate<sup>1</sup>, especially laterally. Ovipositor with the valves relatively short, with a flattened circular expansion on ventral side just before the tip; the details of this cannot be more closely discerned in the unique type.

*Hab.* New South Wales.

*Holotype*, ♀, Wentworth Falls, Blue Mts., November 18, 1921 (*A. Tonnoir*).

This charming fly is dedicated to Miss Joan Edwards, eldest daughter of Fred W. Edwards. The presence of a

spur at the angulated bend of  $R_{4+5}$  near the normal position of  $r-m$  in the genus might indicate that this vein has atrophied in the species, and the outlying element herein treated as being  $r-m$  may be a supernumerary cross-vein.

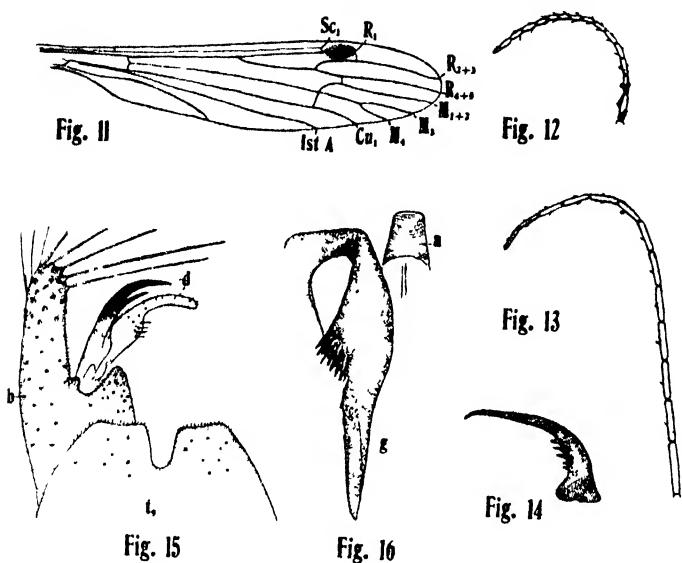
*TONNOIROMYIA*, gen. nov.

Rostrum short; palpi 4-segmented, the terminal segment a little longer and more slender than the penultimate. Antennæ 15-segmented in the male, elongate, if bent backward extending to mid-length of the abdomen; flagellar segments elongate-cylindrical, the verticils very small, scarcely longer than the dense erect pubescence that covers the flagellar segments; flagellar segments gradually narrowed and shortened outwardly. In the female the antennæ are shorter and apparently 16-segmented, there being an additional small terminal segment that seems to be distinct from the penultimate; basal flagellar segment nearly as long as the two following taken together, the segments gradually decreasing in length to the tip (figs. 12, 13).

Pronotum very small, crowded. Pleura with the meron very small. Legs long and slender; tibiæ without spurs; claws (fig. 14) elongate, with a pale microscopic comb of about five teeth on basal half; empodia distinct. Wings (fig. 11) with  $Sc$  elongate,  $Sc_1$  ending a short distance beyond the fork of  $Rs$ ,  $Sc_2$  close to its tip;  $r$  at tip of  $R_1$ , placed about three times its own length beyond the fork of  $Rs$ ; basal section of  $R_{4+5}$  elongate, about equal to the penultimate section of  $R_1$ ;  $r-m$  more than twice its length beyond the fork of  $M$ ; cell 1st  $M_2$  open by atrophy of  $m$ ; cell  $M_3$  about as long as its petiole;  $m-cu$  variable in position, before, at, or some distance before the fork of  $M$ ; vein  $Cu_2$  very faint and ill-defined, becoming obliterated some distance before  $m-cu$ ; vein 2nd  $A$  arcuated, connected with 1st  $A$  only near the base of the large prearcular cell.

Male hypopygium (fig. 15) with the ninth tergite ( $t_9$ ) broadly transverse, the caudal margin with a deep U-shaped median notch, the lateral lobes thus formed broadly truncate. Basistyles ( $b$ ) relatively small, the dorsal lateral angle produced caudad into a clavate fleshy lobe, the surface setiferous, the setæ large and conspicuous at apex, the longest equalling the lobe itself. Ventro-mesal lobe of basistyle slightly produced. Dististyles borne at base of dorsal fleshy lobe ( $d$ ), two in number but closely united by membrane at base; outer arm a blackened curved spine, bearing a smaller

appressed spine just beyond mid-length on the inner or concave face; inner arm subequal in length, paler brown, the basal half expanded and bearing a group of spinous setæ, the apex a flattened, gently curved rod, the tip obtuse, the surface with abundant microscopic punctures. Gonapophyses (fig. 16, *g*) very powerfully developed, arising close to the basistyle, thence bent mesad, the tips hanging pendant



Male genitalia, wing-venation, and other structural details of  
*Tonnoiromyia*, gen. nov.

Explanation of symbols:—*Hypopygial*. *a*=aedeagus; *b*=basistyle; *d*=dististyle; *g*=gonapophysis; *t*=tergite. *Venational*. *Cu*=Cubitus; *1st A*=1st Anal; *M*=Media; *R*=Radius; *Sc*=Subcosta.

Fig. 11.—Wing.

Fig. 12.—Antennal flagellum, ♀.

Fig. 13.—Antennal flagellum, ♂.

Fig. 14.—Claw, ♀.

Fig. 15.—Hypopygium, ♂.

Fig. 16.—Gonapophysis and aedeagus, detached.

as powerful blades, near mid-length expanded, the lateral margin with an extensive group of spines, the apex produced into a long acute point. In a position of rest these spines are directed ventrad and cephalad. Ovipositor with the tergal valves long, slender, the bases straight, the tips suddenly upcurved, acute.



Genotype, *Tonnoiromyia tasmaniensis*, sp. n. (Australian Subregion).

The new genus *Tonnoiromyia* is named in honour of my friend and colleague, Dr. André L. Tonnoir, whose labours in Australia and New Zealand have added vastly to our knowledge of the Diptera of Australasia. I would place this annectant form in the tribe Limoniini, probably as a separate subtribe, the Tonnoiromyariæ, pointing toward the Hexatomini. The elongate antennæ of the male is an almost unknown feature in the Limoniini, but the other features point strongly toward this tribe. The structure of the male hypopygium, especially the gonapophyses, is very remarkable. In some respects the genus suggests *Amphilimnobia*, Alexander (Ethiopian Region), but is not closely allied.

*Tonnoiromyia tasmaniensis*, sp. n.

General coloration shiny black, the thoracic pleura pruinose; subterminal tarsal segments cream-coloured; wings with a dusky tinge, the stigma oval, dark brown.

*Male*.—Length 6–6·5 mm.; wing 7·8 mm.; antenna 5 mm.

*Female*.—Length 6·5–7 mm.; wing 7·5 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments of male with a dense erect microscopic black pubescence and slightly longer black verticils, the longest about one-fourth the length of the segment. Head grey, the centre of the vertex extensively blackened. Eyes of male widely separated, protuberant, with small ommatidia.

Pronotum black. Mesonotum shiny black, only sparsely pruinose, the scutellum a little more so. Præscutal setæ lacking. Pleura with a conspicuous microscopic grey pruinosity on the ventral pleurites and the anterior half of the pleurotergite, this pruinose area further interspersed with small appressed yellow setæ. Halteres with the base and knobs dark brown, the central portion of stem paler. Legs with the coxæ light brown, the fore coxæ darker; trochanters dark; femora and tibiæ black, the bases of former restrictedly paler; apices of basitarsi and tarsal segments 2 and 3 pale brownish yellow, with pale setæ, giving a creamy hue to the tarsi; terminal two tarsal segments brownish black. Wings with a strong dusky tinge; stigma oval, conspicuously dark brown; veins black with small macrotrichiae. Venation (fig. 11): as described under the genus; in some cases  $R_{2+3}$  is weakly spurred near origin;

$r$  is angularly bent near mid-length and may be a composite vein, the cephalic portion being true  $r$ , the caudal portion the base of  $R_2$  with the distal section entirely atrophied; vein  $M_3$  is more nearly in alignment with  $M_{3+4}$  than is  $M_4$ .

Abdomen brownish black, the median region of the sternites paler. Male hypopygium as described under the generic diagnosis. Ovipositor with the basal shield and bases of sternal valves black, the remainder of the valves horn-coloured.

*Hab.* Tasmania.

*Holotype*, ♂, Eaglehawk Neck, Tasman Peninsula, November 23, 1922 (*A. Tonnoir*).

*Allotype*, ♀, Burnie, October 27, 1922 (*A. Tonnoir*).

*Paratopotype*, ♂; *paratypes*, 1 ♂, 1 ♀, with the allotype, October 25–27, 1922; 2 ♀ ♀, Wilmot, January 8, 1923 (*A. Tonnoir*); 1 ♂, National Park, December 15, 1922 (*A. Tonnoir*).

XX.—*The Spedan Lewis South American Exploration.*—  
IV. *List of Mammals obtained by Sr. Budin on the  
Boundary between Jujuy and Bolivia.* By OLDFIELD  
THOMAS, F.R.S.

SEÑOR BUDIN'S next collecting-trip was to the highland country just on the northern edge of Jujuy, and across the boundary in Southern Bolivia, where he obtained about 120 examples, belonging to 15 species. Owing, however, to this being in the near neighbourhood of localities where he had previously collected, the species are in all cases referable to animals already known, thus showing how complete his work has been.

Quite a large proportion of the species now recorded were obtained in Sr. Budin's first collection of all—that at Maimara, near Humahuaca, Jujuy,—of which I gave an account in 1913, while others were found by him during his later Jujuy explorations. Our knowledge of the Jujuy mammalian fauna is, in fact, almost wholly due to him. The present list shows how the same fauna extends northwards, and is of value as helping to map the exact ranges of the various species.

The localities now referred to are, in Northern Jujuy, *Santa Catalina*, 4500 m., about 22° S., 66° W., and, in Southern Bolivia, *Lipez*, 4500 m., about 60 km. to the west

of Santa Catalina, Yuruma, 2200 m., and Tupiza, 2000 m., to the north-east of the same place.

As before, the whole series is presented to the National Collection by Mr. Spedan Lewis, whose help in thus helping the survey of this interesting highland fauna is of the greatest value to science.

1. *Pseudalopex culpaeus andina*, Thos.

♂. 2347. Lipez, 4500 m.

2. *Oryzomys longicaudatus*, Benn.

♀. 2289. Tupiza.

3. *Andinomys edax*, Thos.

♂. 2300; ♀. 2285. Tupiza, 2000 m.

♂. 2302, 2305, 2306, 2327, 2328; ♀. 2308, 2317, 2322, 2323, 2329. Yuruma, Bolivia, 2200 m.

This fine member of the *Phyllotis* group occurs commonly in every collection from the "*Octodontomys* area."

4. *Graomys lockwoodi*, Thos.

♂. 2287, 2295; ♀. 2281, 2283, 2301. Tupiza, 2000 m.

The pectoral area of wholly white hairs is of rather greater extent than in the type, in *domorum*, or *cachinus*, but smaller than in *chacoensis*, where it covers the whole of the under surface. It is no doubt individually variable.

5. *Phyllotis ricardulus*, Thos.

♂. 2313, 2314, 2324, 2330; ♀. 2309, 2315. Yuruma, 2200 m.

♂. 2331, 2340, 2341, 2349, 2359, 2381; ♀. 2336, 2343, 2368, 2387, 2390. Lipez, 4500 m.

Apparently very common from S. Bolivia through Jujuy into Catamarca.

6. *Hesperomys musculus*, Thos.

♂. 2286, 2292, 2293; ♀. 2291, 2297, 2298. Tupiza, 2000 m.

♂. 2392, 2393. Santa Catalina, N. Jujuy, 4500 m.

7. *Auliscomys leucurus*, Thos.

♂. 2374, 2380, 2382, 2383; ♀. 2358, 2365, 2366, 2367. Lipez, 4500 m.

A rare species, of which we are glad to have further

examples. Previously known from Maimara and the Sierra de Zenta, Jujuy.

8. *Neotomys vulturinus*, Thos.

♂. 2373, 2384; ♀. 2357, 2372. Lipez.

Described on Budin specimens from the Sierra de Zenta, Jujuy, since obtained by him at Tarija, Southern Bolivia, and by Mr. Shipton's collector J. Morgensen on the Aconquija Mountain, Catamarca.

9. *Akodon jucundus*, Thos.

♀. 2375. Lipez, 4500 m.

Also recently obtained by Mr. Shipton's collector at Aconquija. Originally captured in Maimara, Jujuy.

10. *Bolomys albiventer*, Thos.

♂. 2360, 2369, 2371, 2377, 2385, 2391; ♀. 2337, 2351, 2364, 2370, 2376. Lipez, 4500 m.

11. *Chraomys bacchante sodalis*, Thos.

♂. 2352, 2362, 2363; ♀. 2344, 2348, 2356, 2361. Lipez, 4500 m.

One of the most beautiful of all Muridæ. Besides discovering it originally in 1912 near Maimara, Jujuy, Sr. Budin sent in 1921 a small series of the same form from the Sierra de Zenta in that province.

12. *Octodontomys gliroides*, d'Orb.

♂. 2304, 2326; ♀. 2311, 2312, 2325. Yuruma, 2200 m.

♀. 2346. Lipez, 4500 m.

This fine species is characteristic of the alteplanic, and has been obtained in some numbers by both Messrs. Simons and Budin. So far as our material is concerned, its range extends from La Paz through Southern Bolivia to Central Jujuy, N. Argentina.

13. *Lagidium vulcani*, Thos.

♂. 2386; ♀. 2354. Lipez, 4500 m.

14. *Galea musteloides*, Mey.

♂. 2290, 2299; ♀. 2284, 2288. Tupiza, 2000 m.

♂. 2350, 2379. Lipez, 4500 m.

15. *Marmosa elegans pallidior*, Thos.

♀. 2310. Yuruma, 2200 m.

XXI.—*Notes on the Asteroidea.*—IV.

By W. K. FISHER, Hopkins Marine Station, California.

I. THE NAME *ECHINASTER SEPOSITUS*.

The following discussion bears upon the note of the above title, by Dr. Mortensen, in the *Ann. & Mag. Nat. Hist.* for November 1925 (vol. xvi. p. 546).

Dr. Mortensen believes that *Echinaster sepositus* is the correct name for the Mediterranean *Echinaster*. In two notes\* I pointed out reasons for considering *sepositus* untenable and *sagenus* the correct name of the well-known species.

It will simplify a case somewhat complicated in verbiage if we consider at present only the first *Asterias seposita*, Retzius, 1783, since it is the only *seposita* which can be used. Dr. Mortensen thinks that the name refers to the Mediterranean *Echinaster*; I think that it refers to the common North Atlantic *Henricia sanguinolenta*. The use of *seposita* for the Mediterranean species hinges entirely upon which of the above forms was used as the type.

As Dr. Mortensen has quoted, Retzius states, in his paper, "Anmärkningar vid Asteriæ Genus": "*Asterias seposita* stellata, radiis quinq. teretibus, subtus reticulatis; supra aculeatis; aculeis pectinatis. Finnes vid Torekov, fast nog liten. Linck, t. 4. f. 5.—t. 9, f. 16.—t. 30, f. 62."

Retzius indicates a definite type-locality—Torekov, Sweden—where no true *Echinaster* is found. He describes a form which had already been named *Asterias sanguinolenta* by O. F. Müller (1776). That Retzius regarded Linck's figures of the Mediterranean *Echinaster* to represent the adult of his *Asterias seposita* has no bearing on the fate of *seposita* as a name, for, by indicating a type-locality, he virtually (in this instance) designates a type, thus: Torekov, Sweden—therefore, *Henricia sanguinolenta*.

*Asterias seposita* automatically becomes a pure synonym of *Asterias sanguinolenta*. It cannot by the process of inverted elimination suggested by Dr. Mortensen be used for the Mediterranean species.

The Mediterranean *Echinaster* was therefore without a name in 1783, having been mistaken for the adult of *Henricia sanguinolenta* (*Asterias seposita*). The first name proposed

\* Zool. Anz. vol. xlii. no. 5, 1913, p. 194; Bull. U.S. Nat. Museum, 100, vol. iii, 1919, p. 428.

thereafter was *Asterias sagera*, by Retzius ('Dissertatio,' 1805), whence *Echinaster sagerus*.

This opinion has been submitted to Dr. Leonhard Stejneger and Dr. A. Wetmore, of the U.S. National Museum, who concur.

Dr. Mortensen has performed a distinct service in explaining the "mystery" concerning the authorship of the 'Dissertatio sistens species cognitæ Asteriarum.'

## II. IDENTIFICATION OF SOME LITTLE-KNOWN GENERA AND SPECIES.

*Lytaster inequalis* (Perrier, Expéditions Sci. du 'Travailleur' et du 'Talisman,' 1894, p. 98, pl. 9. fig. 1).—I examined the seven small types at the Muséum d'Histoire Naturelle. In my synopsis of the Asteriidae this genus gave me considerable trouble, since Perrier's figure shows the infero-marginal spines in transverse combs of three. As a matter of fact, the infero-marginals have only two spines and alternate supero-marginals one. There are no actinal plates. These types are very young specimens of *Coscinasterias tenuispina*.

*Anasterias minuta*, Perrier (Muséum d'Histoire Naturelle; specimen labelled type E 792, Hombron et Jacquemot, 1847, in alcohol).—I subjected the abactinal surface to treatment with potassium hydrate, which reveals a fairly definite series of small carinal plates, between which and the regular supero-marginal plates (each with one short spine) is an irregular, very open, incomplete net of plates. Incorporated in this net there is a transverse tongue of plates extending toward the carinal series from each supero-marginal (about fourteen to a side).

*Anasterias minuta*, far from lacking an abactinal skeleton, merely has it hidden by the integument. The species appears to be one of the numerous variations of *Sporasterias antarctica*.

Koehler\* has already stated that he believes the type of *A. minuta* to be identical with the young of *Sporasterias antarctica*. It is inevitable that the genus heretofore known as *Sporasterias*, Perrier, 1894, be known by the earlier name *Anasterias*, Perrier, 1875; type *Anasterias minuta*, Perrier, i. e., *Anasterias antarctica* (Lütken).

The group currently called *Anasterias* I renamed *Lysasterias* in 1908 (Smithsonian Miscell. Coll. vol. lii. p. 87; see also Ann. & Mag. Nat. Hist. ser. 9, vol. x. 1922, p. 592).

\* Australian Antarctic Expedition, 1911-14, Echinodermata Asteroidea (ser. C, vol. viii. pt. 1, Nov. 1920, p. 12).

*Asterias capensis*, Perrier (Rév. Stell. 1875, p. 73).—The types, four very young specimens from the region of the Cape of Good Hope, are in the British Museum (Natural History). Three have six rays and one has five; the largest with R 12 mm. They appear to be the young of *Cosmasterias felipes* (Sladen, 1889), from south of the Cape of Good Hope. It is hazardous to be too positive, since these types are so young that they have not yet developed actinal plates nor the characteristic unguiculate straight pedicellariæ. Eventually, however, I think we shall have to discard Mr. Sladen's admirable name for *Cosmasterias capensis* (Perrier).

*Asterias inermis*, Bell.—The type in the British Museum is labelled "Ecuador, 55.10.3.114, Hassler Coll." This is a stout-rayed *Leptasterias grænlandica*, forma *cribraria*, having the thick pads of adambulacral spinal pedicellariæ characteristic of examples from Bering Sea. (Bell, P. Z. S. 1881, p. 512, pl. xlvii. figs. 2, 2 a.)

*Asterias philippii*, Bell.—The two types, in the British Museum, are labelled "South America, Hassler Coll." These specimens are *Leptasterias polaris acervata* (Stimpson), with a well-developed central spine to each abactinal heap of enlarged granules. They are very nearly identical with Stimpson's type of *Asterias acervata* and undoubtedly came from Bering Sea! (Bell, P. Z. S. 1881, p. 511, pl. xlvii. figs. 1, 1 a.)

*Asterias nautarum*, Bell.—The four types, derived from the Hassler Collection, are labelled "55.10.3.115, 116, Ecuador." They are typical *Leptasterias arctica* (Mundoch), abundant in Bering Sea and to the north of Bering Straits. Although Sladen ('Challenger' Asteroidea, p. 824) lists this name, I cannot find any published description.

*Asterias nuda*, Perrier, 1875.—Type from Port Lincoln, South Australia, British Museum, 40.11.30.26. R. B. Harvey, Esq. This is a species with short stout rays, and should be known as *Uniophora nuda*.

*Asterias sinusoida*, Perrier, 1875.—The type, in the British Museum, is from Hobart Town, Tasmania (register no. 42.11.11.12). Until *Uniophora* has been given a thorough overhauling, it cannot be determined whether *Uniophora sinusoida* is distinct from *Uniophora fungifera*. They may represent slenderer and stouter spined examples of the same species. I have examined the types of both; that of *Asterias fungifera*, Perrier, 1875, is in the Muséum d'Histoire Naturelle. *Uniophora globifera*, Gray, is a synonym of *Asterias granifera*, Lamarck. *Uniophora granifera* is characterized

by relatively huge, globose, and toadstool-shaped abactinal spines.

### III. *PERISSASTERIAS*, H. L. Clark.

This genus of the Asteroiidae was described\* from an incomplete specimen taken in 156 fathoms, 42 miles off Cape Town, South Africa. Dr. Clark has kindly allowed me to make a study of additional material received after the publication of his report.

*Perissasterias polyacantha* belongs to the Asteroiinae as defined in my synopsis of the Asteroiidae, its nearest relatives being *Asterias* and *Evasterias*, from both of which it differs in the unusual development of the adambulacral armature. The plates are short and wide, and carry a transverse series of five slender crowded spines proximally (varying to four), and four or three distally. These transverse combs are close to one another, owing to the shortness of the plate, the actinal surface sufficing only for the articulation of the spines. The furrow-member of alternate combs is not noticeably or regularly advanced into the furrow. Each spine carries a small tuft of rather generalized lanceolate straight pedicellariae.

The genus further differs from *Asterias* (and agrees with *Evasterias*) in having a broad actinal area paved with, proximally, four longiseries of four-lobed actinal plates, the rudiments of a fifth being present at the base of the ray.

I believe that *Perissasterias* is not closely related to *Evasterias*, even if both have the common character of numerous actinal plates. In *Evasterias* the actinostome is notably sunken, the mouth-plates small, and the three to five pairs of adambulacrals immediately back of the mouth-plates are in contact to form a narrow adoral carina. *Pisaster*, another genus wholly unrelated to *Evasterias*, has a similar narrow adoral carina and an extensive actinal area. In *Perissasterias* the mouth-angle is more "primitive," the actinostome less sunken. The mouth-plates are broad and the postoral adambulacrals do not form a narrow ridge. About three pairs are in contact; the plates of the first two pairs each carry two spines; those of the next two pairs, four each.

The pedicellariae are not distinctive. The crossed are similar to those of *Asterias* and form small wreaths around the acicular abactinal and marginal spines and tufts on the

\* "The Echinoderm Fauna of South Africa," *Annals of the South African Museum*, vol. xiii. pt. 7, May 1923, p. 307, pl. 18. fig. 3.



actinal. The small straight pedicellariæ are of the generalized, lanceolate, pointed form, scattered over the integument, and predominate on the actinal spines. They occur along the furrow-face of the adambulacral and on the adambulacral and oral spines.

The plates of the skeleton are primarily four-lobed. The abactinal skeleton is rather irregular, the primary plates becoming sometimes three-lobed. They are connected in a transverse direction by oblong secondary ossicles, leaving medium-sized intervals, four to six of which can be counted between the carinal and supero-marginal series. The carinal series is conspicuous, the four-lobed plates being directly imbricated and each bears a stout, tapered, rather sharp spine; the other abactinal plates carry one smaller similar spine, while the marginals and actinals carry three, sometimes four. The marginal and actinal skeleton is regular, there being proximally six regular longiseries of papular areas—one supramarginal, one intermarginal, four actinal. The adradial series on either side of the carinals is also fairly regular, but the three or four areas between this and the supramarginal do not form longiseries.

My key to the genera of Asteroidea may be modified, on p. 598\*, as follows:—

4. Abactinal skeleton an irregular net, with meshes of various sizes, etc.

a<sup>1</sup>. Adambulacral spines provided with clusters of straight or of straight and crossed pedicellariæ, or, exceptionally, with only single pedicellariæ.

b<sup>1</sup>. Adambulacral plates diplacanthid, or mixed diplacanthid and triplacanthid, or mixed diplacanthid and monacanthid.

*Asterias, Evasterias, Urasterias, Leptasterias.*

b<sup>2</sup>. Adambulacral plates with crowded transverse combs of four or five spines; actinal area extensive with three or four longiseries of well-developed four-lobed spiniferous plates; mouth-angle rather broad; gonads opening dorsally. Type, *P. polyacantha*, Clark . . . . .

*Perissasterias*, Clark.

b<sup>3</sup>. Adambulacral plates monacanthid; with actinal plates in one inconspicuous series or lacking, and gonads opening ventrally; size small; pedicellariæ on adambulacral spines rather few and inconspicuous. (Formæ of several species.) . . . . .

*Leptasterias*, Verrill.

Pacific Grove, California.

\* "A Preliminary Synopsis of the Asteroidea," Ann. & Mag. Nat. Hist. ser. 9, vol. xii. 1923, p. 598.

XXII.—*A new Brachycephalid Frog from Brazil.*  
By H. W. PARKER, B.A.

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DURING an examination of the type-series of *Oocormus microps*, Bouleng., it was noticed that the three "young" were not of the same species as the "adult." The description of *O. microps* was undoubtedly drawn up from the largest specimen, and this must consequently remain the type of the species; the "young," however, appear to belong to an undescribed species of the genus *Sminthillus*, Barbour and Noble. Dr. G. K. Noble has very kindly examined some sketches which were submitted to him, and compared them with the type-specimen of *S. peruvianus*; he agrees that this new frog should be referred to *Sminthillus*, despite the fact that it possesses simple instead of T-shaped terminal phalanges and has the tympanum concealed instead of visible.

*Sminthillus brasiliensis*, sp. n.

Type-specimen a female (no. 1902. 11. 25. 8 in the British Museum) from the Organ Mountains, Brazil.

Snout rather acute, slightly longer than the greatest diameter of the eye; canthus rostralis distinct; loreal region nearly vertical; nostril midway between the tip of the snout and the anterior border of the orbit; interorbital space considerably broader than the upper eyelid; tympanum not visible. Limbs weak; digits short, with small, elliptical, terminal discs; subarticular tubercles strongly developed; first finger slightly shorter than the second; fourth much shorter than the first; outer toe shorter than the second. Two flat metatarsal, but no tarsal tubercles. The tibio-tarsal articulation reaches the tympanic region when the hind limb is adpressed. Skin smooth above and below; hinder side of thighs granular.

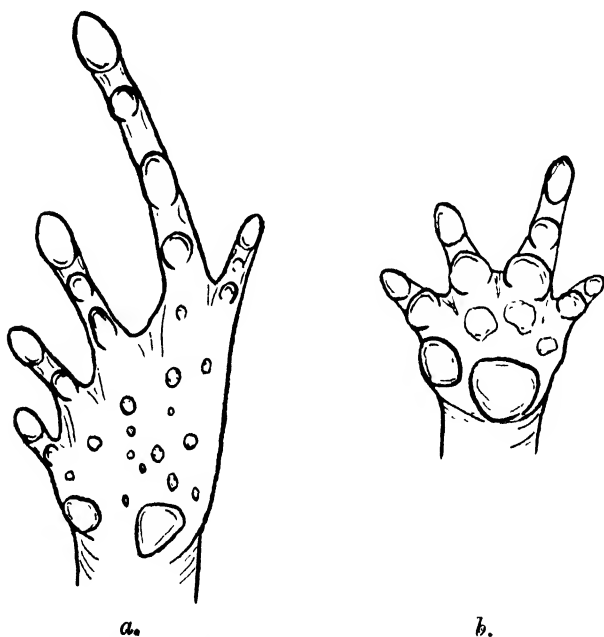
*Colour in spirit.*—Purplish brown above, lighter and white-dusted beneath; a dark brown streak from the tip of the snout to the fore limb, entirely covering the loreal region and the upper lip, bordered above by a narrow black line; an indefinite X-shaped dark mark on the anterior part of the back and a few irregular dark spots posteriorly and on the flanks. Hind limbs indistinctly barred with darker; a narrow white line on the posterior face of each thigh, joined

above the vent by a very fine median dorsal line which extends anteriorly almost to the occiput.

*Dimensions.*

	mm.
Snout to vent .....	18
Fore limb .....	9
Hind limb .....	22

Two paratypes (both females) agree with the type in all essentials; the larger (19 mm. from snout to vent) contains ovarian eggs which are approximately 2 mm. in diameter.



*Sminthillus brasiliensis*, sp. n.    *a*, left foot; *b*, left hand.

Noble\*, in discussing the relationships of the two previously known species of this genus, considers that "it is certainly simpler, when all things are considered, to assume that *S. limbatus* in Cuba and *S. peruvianus* in Southern Peru have arisen independently from a *Syrrhopus* or *Eleuthero-*  
*dactylus* stock, rather than to try to account for the distribution

\* Am. Mus. Novitates, xxix. p. 1 (1921), and Bull. Amer. Mus. N. H. xlv. Art. I. p. 18 (1922).

by assuming a former greater range and at present restricted distribution." The discovery of *S. brasiliensis* in eastern Brazil extends the known range of the genus considerably, but in no way tends to make it continuous; it serves, however, to emphasize the possibility that the discontinuous distribution of the genus may be more apparent than real, due to our very imperfect knowledge of the smaller batrachians of the intervening territories. Morphologically, too, the new species tends to show that *Sminthillus* is a natural genus and not a polyphyletic assemblage; it has the same "arcifero-firmisternal" shoulder-girdle as the previously known species, and differs osteologically only in the shape of the terminal phalanges. These are simple instead of T-shaped; the very short fingers and almost rudimentary outer finger and toe show, however, that the digits in this species have undergone very considerable reduction, and a corresponding modification of the phalanges is only to be expected. *S. brasiliensis* cannot be said to be in any way intermediate between *S. limbatus* and *S. peruvianus*, but, though it resembles the latter species in many respects (particularly in the shape and disposition of the palmar and metatarsal tubercles), it has no tarsal tubercle and has the rather acute snout and the digital discs which characterize the former.

### XXIII.—*A new Lizard from South Australia.*

By H. W. PARKER, B.A.

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THE lizard described below formed part of the collection made in 1921 by Professor Wood-Jones in Nuyts' Archipelago and the Investigator's Group, South Australia.

#### *Lygosoma (Rhodona) terdigitatum*, sp. n.

*Lygosoma (Hemiergis) decresiensis* (non Fitz.), Procter, Trans. R. Soc. S. Austral. xlvii. no. 5, 1923, p. 81.

Type-specimen an adult, no. 1922. 11. 8. 32 in the British Museum, from Flinders Island, Investigator's Group, South Australia.

Body much elongate; limbs weak, tridactyle; the distance between the end of the snout and the fore limb is contained twice and a quarter in the distance between axilla and groin.

Snout moderate, obtusely conical. Lower eyelid with an undivided transparent disc. Nostril pierced in a rather large nasal, which is just separated from its fellow; fronto-nasal large, broader than long, broadly in contact with the frontal; præfrontals small and widely separated; frontal broader than the supraocular region, longer than the fronto-parietals and interparietal together, in contact with the first and second supraoculars; four supraoculars, second largest, fourth small; six supraciliaries; fronto-parietals and interparietal distinct, subequal; parietals forming a suture behind the interparietal; three pairs of enlarged nuchals; six upper labials, the fourth entering the orbit. Ear-opening scarcely distinct. 20 smooth scales round the middle of the body, dorsals largest. A pair of enlarged præanals. Hind limb as long as the distance between the anterior corner of the eye and the fore limb. Toes very unequal, the third longest, three times as long as the first.

*Colour in spirit.*—Olive-brown above, with four very fine longitudinal dark lines on the back; a well-defined dark dorso-lateral band from the tip of the snout, through the eye, to above the hind limb; flanks and lower surfaces white, with longitudinal rows of small black dots; throat and subgular region immaculate.

	mm.
Total length .....	111
Hind limb .....	14
Fore limb .....	7
Tail .....	57

The condition of the ear-opening would, at first sight, appear to relate this species to the subgenus *Hemiergis*. It differs, however, from all the described species of that subgenus in the much larger frontal, which is broader than the supraocular region and longer than the interparietal and fronto-parietals together, a larger transparent palpebral disc, and the absence of suboculars separating the upper labials from the orbit. All these characters are found in those species of the subgenus *Rhodona* which are grouped round *L. bougainvilli* (Gray), and in which also the ear-opening is very minute. The foregoing description will be found to agree very closely with that of *L. fragile*, Günth., and it is to this species that the new one appears to be most closely related. *L. terdigitatum* is distinguishable from *L. fragile* by its paired fronto-parietals, separated nasals, and rather longer fronto-nasal.

In 1915 Boulenger\* described a lizard from Yallingup, S.W. Australia, as *Lygosoma peronii*, var. *tridactylum*. He was led to describe this form, which has three fingers and three toes, "as a variety or subspecies rather than as a species," owing to the presence of a specimen with four fingers and three toes amongst a series of normally tetradactyle *L. peronii* from Coolgardie. This Coolgardie specimen, however, agrees very well in essentials with the description of *Lygosoma (Hemiergus) woodwardi*, Lucas and Frost. Consistency, therefore, demands either that *tridactylum* be regarded as a distinct species or *woodwardi* as a subspecies of *peroni*; Zeitz, in his "Catalogue of Australian Lizards"†, recognizes *L. woodwardi* as a valid species, and so, until it is shown that he is in error, *L. (Hemiergus) tridactylum*, Bouleng., must be given the same status.

#### XXIV.—Description of a new Snake from Trinidad.

By H. W. PARKER, B.A.

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THE snake described below as a new species of the genus *Dipsas* was collected in a bromeliad attached to a fallen forest-tree by Dr. E. Lehner. Mr. F. W. Urich, who has generously presented this and many other specimens to the British Museum, writes as follows concerning the animal:—"... I suspect that these snakes live almost entirely in bromeliads on tall trees..." Among the contents of the rectum the only recognizable remnant is a radula which has been kindly identified for me by Col. A. J. Peile as probably that of *Auris (Eudolichotis) glabra*, Gmel. This new species therefore probably resembles its congeners in being arboricolous and malacophagous.

The snakes *Sibynomorphus (Leptognathus) albifrons* (Sauv.) and *S. variegata* have been referred to the genus *Dipsas*, Laur., by Mocquard‡ and Amaral§ respectively, on the ground that they lack pterygoid teeth. Examination of the

\* Boulenger, Ann. & Mag. Nat. Hist. (8) xvi. p. 65 (1915).

† Rec. S. Austral. Mus. vol. i. no. 3, p. 215 (1920).

‡ Miss. Sc. Mex. iii. livr. 16, p. 898.

§ Com. Lin. Telegr. Estrat. Matto Grosso, Amaz. no. 84, Annex 5, Zool. p. 28 (1925).

specimens in the British Museum confirms the absence of these teeth in *S. albifrons*, but of the two specimens of *S. variegata* one lacks pterygoid teeth, whilst in the other there are 3 on each side. The snake described below, which is closely allied to *S. variegata*, has 2 or 3 teeth on each pterygoid; that recently described by Amaral\* as *Dipsas neivai* is also closely allied to *S. variegata*, but lacks such teeth. Three specimens of *S. oreas* (Cope) from the same locality (specimens *a-c* of *S. mikanii*, var. *c* in Boulenger's Catalogue) have 0, 2, and 8 teeth respectively; the number of such teeth in the other species of *Sibynomorphus* examined varies from 4 (*S. andiana*) to 20 (*S. catesbyi*). It appears, therefore, that the presence or absence of pterygoid teeth provides no definite distinction between the genera *Sibynomorphus* and *Dipsas*, the species grouped round *S. variegata* showing a complete gradational series from one condition to the other. As these genera are not separated on other grounds, they must be united, and *Dipsas* as the prior name takes precedence.

*Dipsas trinitatis*, sp. n.

Type-specimen a ♂ (immature?), no. 1926. 5. 1. 1 in the British Museum, from Trinity Hill Reserve, Trinidad, British West Indies.

Body strongly compressed. Eye large. Rostral broader than deep, just visible from above; internasals shorter than the præfrontals; frontal as long as broad, as long as its distance from the end of the snout, shorter than the parietals, which are as long as the frontal and præfrontals together; nasal semidivided; loreal deeper than long, bordering the eye; a small præocular; præfrontal not entering the eye; two postoculars, the lower much larger than the upper; temporals 2+3 (on the left side the three upper temporals which border the parietal are fused to form one long band-like scale); eight upper labials, third and fourth or fourth and fifth entering the eye; first two pairs of lower labials forming a suture behind the symphysial; two pairs of chin-shields, as long as broad. Scales in 15 rows at mid-body (formula 17. 15. 15), vertebrals moderately enlarged, ventrals 188; anal undivided; subcaudals 95.

*Colour in spirit*.—Light brown above, with dark brown, light-edged, and light-centred alternating spots on the flanks; between the members of this principal series of markings there is a series of similar but smaller spots on the lower

\* Arch. Mus. Nac. Janeiro, xxvi. p. 14, pl. ii. (1926).

lateral scales and the outer ends of the ventrals; light ground-colour shot with short, narrow, dark streaks; a pair of indefinite dark streaks from the parietal shields to the sides of the neck. Beneath yellow, dusted with darker posteriorly.

Total length 275 mm.; tail 70 mm.

This species appears to be most closely allied to *D. variegata* (Dum. & Bibr.), *D. albifrons* (Sauv.), and *D. neivai*, Amaral. From *D. variegata* it is distinguished by the presence of a præocular, two instead of three upper labials entering the eye, eight instead of nine or ten upper labials, and the colour-pattern; from *D. albifrons* by the different arrangement of the temporals, the shorter frontal and loreal, two instead of three pairs of chin-shields, and the larger number of ventrals and subcaudals; from *D. neivai* by the shorter loreal, the presence of a præocular, two instead of three upper labials entering the eye, and the larger number of subcaudals.

## XXV.—Some new Eastern Sphingidæ in Tring Museum.

By Dr. KARL JORDAN.

### 1. *Theretra muricolor*, sp. n.

Near *Th. queenslandi*, Luc. (1891). Smaller, much greyer, costal edge of fore wing not pale. Ground-colour of upperside drab, centre of meso-metathorax and abdomen paler than sides, the dark greenish sepia dorso-lateral stripe of abdomen diffuse, broad and very conspicuous, fading away on segment 5. On fore wing, above, the darkish shading at outside of broad discal line faint, usually bounded by a slight vestige of a line, some specimens (incl. of type) with an indication of a submarginal line; stigma prominent; no cloud-like discal patch. Pale costal area of hind wing wider than in *Th. queenslandi*.

Underside nearly as in *Th. radiosa*, R. & J. (1916), with a slight but distinct pink tint; the row of black discal dots conspicuous on both wings; fringe of fore wing blackish above and below.

A series from Talasea, north coast of New Britain (*A. F. Eichhorn*), i.-iv. 1925.



2. *Theretra rhesus valens*, subsp. n.

Upperside paler than in *Th. rhesus insularis*, Swinh. (1892), from Ceram and New Guinea; the basal lateral spot of the abdomen not black, but of the same greenish tint as the discal line of the fore wing; anal area of hind wing paler and on the whole larger than in *insularis*.

A series. Type from Talasea, New Britain (A. F. Eichhorn); also from New Ireland and New Hanover.

3. *Theretra rhesus mollis*, subsp. n.

Upperside much more strongly washed with green than in *Th. rhesus valens*, the stripes of the abdomen of this same greenish colour, the black basal lateral spot at most vestigial. No black scaling at apex of antennæ. Black area of hind wing much reduced, recalling *Th. clotho celata*, Butl., being as a rule narrower than the pale marginal area.

Underside yellowish as in *Th. rhesus valens*, the black area of fore wing smaller, at least in ♂.

A small series from St. Mathias and Squally Islands (A. F. Eichhorn). Type from St. Mathias.

4. *Theretra rhesus lenis*, subsp. n.

*Theretra clotho celata*, Roths. & Jord. Revis. Sphingidæ, p. 709 (1903) (partim). (Tulagi and Treasury.)

Similar to *Th. rhesus mollis*, but the lines on the abdomen indistinct, the stigma of the fore wing smaller, the two lines between the strong discal line of the fore wing and the termen vestigial, represented by more or less dispersed dark scales, the inner line particularly being faint. Pale border of hind wing as broad as in *Th. rhesus mollis*.

Underside more pinkish and the postmedian line and the subapical spot of the fore wing more prominent.

Solomon Islands, three ♂♂. Type from Treasury.

5. *Theretra indistincta bismarcki*, subsp. n.

Similar to *Th. indistincta papuensis*, Joic. & Talb., 1921 (erroneously described as a subspecies of *Th. clotho*). On the upperside the dark discal cloud which crosses the fore wing from the costa to the hind margin near tornus is, as a

rule, more pronounced than in the specimens of *papuensis*; the discal line is anteriorly curved costad away from the oblique apical line, but in ♂ sometimes almost joins this line. On hind wing the pale anal patch nearly always continued forward, more or less separating a black diffuse marginal band from the black discal area except costally.

Underside more variegated than in *Th. indistincta papuensis*; on fore wing a diffuse discal line runs from the black area to costal margin; parallel with this line a row of vein-dots, starting at costal margin with the subapical dot (present also in *Th. i. papuensis*) and running across both wings; oblique apical line rather less distinct than in *Th. i. papuensis*. On hind wing, parallel with the row of dots, a median line as distinct as in *Th. i. manuselensis*, Joic. & Talb. (1921).

A series from the Bismarck Archipelago. Type from New Ireland.

#### 6. *Theretra molops*, sp. n.

Similar to *Th. muricolor* and *Th. i. bismarcki*. Abdomen paler above than at the sides, but the dorso-lateral stripe less prominent and shorter than in *Th. muricolor*; centre of meso-metanotum hardly paler than patagia. Scaling of antenna pinkish.

Upperside of wings nearly as in *Th. i. bismarcki*, but paler, the dark discal cloud of the fore wing less distinct, the oblique line much broader and more oblique posteriorly, but not so broad as in *Th. muricolor* and not continued basad at hind margin, costally continuous with the oblique apical line; at the outside of the discal line a broadish dark shade, which gradually fades away distally; costal edge pinkish; stigma minute. The clayish costal area of hind wing somewhat smaller than in *Th. i. bismarcki* and the anal area paler.

On the underside the black area of the fore wing extends nearer to the costal margin than in *Th. muricolor* and *Th. i. bismarcki*; the black line which runs from the black area forward is either vestigial or distinct; the oblique apical line extends down to about middle; the subapical black dot minute, no row of dots. On hind wing the postmedian line vestigial, a row of very small and indistinct dots on disc.

A series of ♂♂ from New Ireland (*A. F. Eichhorn*).

XXVI.—*Note on a rare Atlantic Hydroid.*

By A. K. TOTTON.

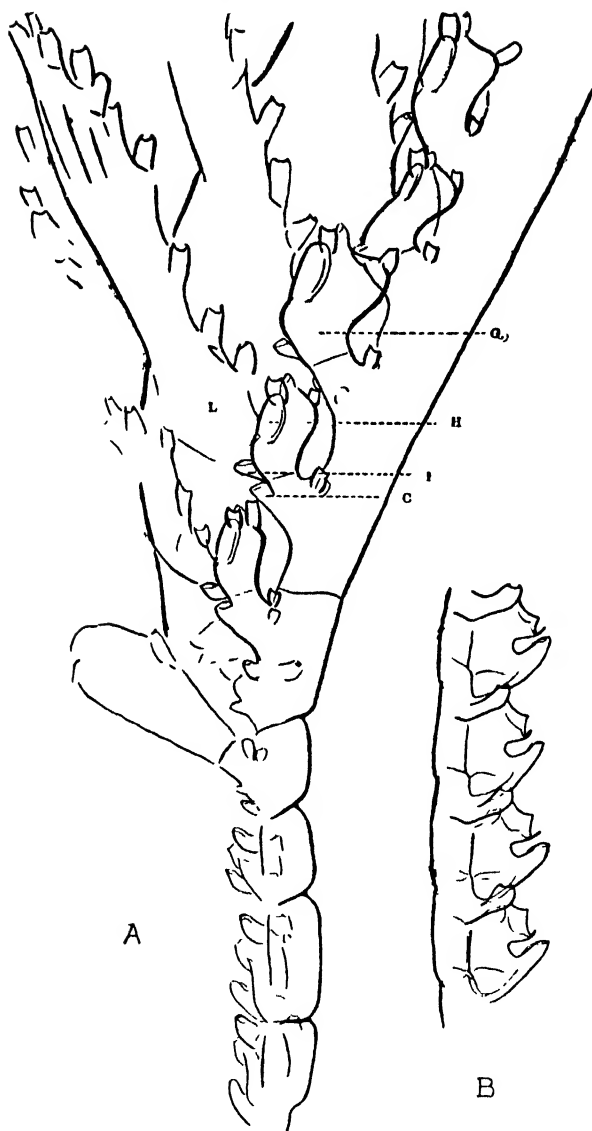
(Published by permission of the Trustees of the British Museum.)

*Thecocarpus contorta* (Nutting), 1900.

Six specimens of a very little known hydroid, *Aglaophenia contorta*, Nutting, have just come to light at the British Museum. As I cannot find any reference of importance to this species made since it was instituted, it will be useful to supplement the original description. The only records of its occurrence that I can find are :—(1) off Key West and Marco, Florida, in 2 and 5½ fathoms of water (Nutting, 'American Hydroids,' 1900), (2) Tortugas (Wallace, Carnegie Inst. Washington, Year-Book for 1908, 1909).

The present dried specimens were collected about forty years ago by Dr. Gardner off Rio de Janeiro, Brazil. They are unbranched and from 9 to 11 cm. in height. In the four specimens that are complete at distances of 8, 22, 23, and 28 mm. respectively from the hydrorhizal tubes there are two consecutive nodes forming oblique hinge-joints. These are structures that are found in many groups and to which I shall be alluding elsewhere. They have been referred to by writers as "pinched places." Between the two nodes that I have described is a large median nematotheca. Below them there are no nematothecæ, but the stem is marked by irregular transverse nodes at intervals. Above the pair of hinge-joints the stem bears oblique nodes at regular intervals, though, from the secondary deposition of chitin, in the proximal region they are scarcely visible. Each internode bears a mesial and a pair of supra-calycine nematothecæ, but no hydrotheca. In its place is a *mamelon*, from the side of which, alternately to left and right, arise the hydrocladia. These are about 0.68 mm. apart on the same side, 5 mm. long, and consist of approximately nineteen hydrothecate articles.

The corbulæ, which, judging by the open ends, are not fully grown, measure as much as 8 mm. in length including the peduncle. The closed-in part forms a cylinder from 0.7–0.8 mm. in diameter. The free edges of the leaflets extend up to 0.8 mm. beyond this. The corbula rachis is about 0.2 mm. in diameter. The peduncle of the corbula bears two or three normal hydrothecate articles. These are followed by an article bearing the full complement of nematothecæ and



*Thecocarpus contorta* (Nutting), 1900.

- A. Semidiagrammatic sketch of base of corbula,  $\times 53$ . g., gono-hydroclade; h., vestigial hydrotheca; i., infrathecal median nematotheca of vestigial hydrotheca; c., infrathecal median nematotheca of corbula-rachis; L., corbula-leaflet.
- B. Part of hydroclade,  $\times 53$ .

a mamelon but no theca, and from it arises a rudimentary branch. The succeeding articles of the corbula rachis are not very distinctly marked off from one another. The proximal three or four are similar to that just described in having both supra-calycine cauline nematothecæ, but distally to this the inner one disappears. Also all the articles of the rachis after the peduncle and the next one or two bearing the first rudimentary branches appear to have the *mamelon* suppressed. The gonohydroclade or branch ("lateral spur," auct.) which arises from the apophysis bears a minute vestigial hydrotheca, apparently closed, above which is the usual pair of supra-calycine nematothecæ. Below it is a median infrathecal one. From a spot between the latter and the vestigial hydrotheca arises the secondary branch or corbula-leaflet. The gono-hydroclade generally bears, in addition, a single "dorsal" nematotheca. The distal edge of each leaflet bears a series of nematothecæ, separated by what appear to be radial septa. The only nematothecæ on the proximal side are two at the base already mentioned, the lower of which is a cauline one and probably represents the median infrathecal of the suppressed cauline theca, while the other is the infrathecal nematotheca separated from its vestigial gono-hydrocladial ("spur") theca by the hypertrophied corbula-leaflet.

It will be seen that the corbula is of the type found in species which are generally grouped under the generic name *Thecocarpus*, and although this group appears to be a polyphyletic one, until the species of *Aglaophenia*, *Thecocarpus*, and *Lytocarpus* can be classified and the nomenclature set right, it will be best perhaps to use this name for the present species.

XXVII.—*A new Subspecies of Dik-dik* (Madoqua). By R. E. DRAKE-BROCKMAN, D.S.O., M.D., M.R.C.S., F.Z.S.

SOME years ago one of my collectors obtained for me around Eli Hur, near Obbia, in Italian Somaliland, several specimens of a dik-dik which I provisionally classified as *Madoqua phillipsi*.

Recently while considering the geographical distribution of the Somali dik-diks I thought I might try to fill up the gaps in our knowledge now that the Mad Mullah and his followers had ceased to exist in that vast region to the north-west,

west, and south-west of Cape Guardafui, inhabited by the Mijertain Somalis. Towards the end of 1925 I asked Major A. S. Lawrance, D.S.O., who had travelled extensively in the northern part of the above-mentioned region, if he would try and get me some specimens of the dik-diks in those parts. Recently nine specimens reached the Natural History Museum from El Lagodhey (two), Las Dureh (two), Kelma, near Waqderia (three), and between Ras Adado and Al hills (two), and of these the two specimens from El Lagodhey were identical with those collected some years previously around Eil Hur. The remaining seven specimens all belong to the coastal subspecies *M. phillipsi gubanensis*.

On comparing the two El Lagodhey specimens with the others from Eil Hur, and contrasting them with the true *M. phillipsi* which is found on the Golis Range and from there to Hargeisa, one cannot help being struck by the difference in the appearance of the specimens from these two areas so far removed from each other. In view of the constant dissimilarity in the specimens from these two areas, I propose to give subspecific rank to this southernmost relative of *M. phillipsi*, and name it in honour of my friend Major A. S. Lawrance, who has served so many years with distinction in the Somali country.

*Madoqua phillipsi lawrancei*, subsp. n.

Closely allied to *M. phillipsi*, with which it agrees in size and skull-measurements, but differing from it in the general colour of its pelage. The fine grizzling of the back is very similar to that of *M. piacentini*, and this never fades into the brilliant rufous on the flanks and shoulders, as is almost invariably the case in *M. phillipsi*, there being a more or less distinct line of demarcation between the grizzling of the back and the rufous of the sides and legs. The grizzling is quite free from any brown suffusion, so conspicuous a feature in both *M. phillipsi* and *M. phillipsi hararensis*, in consequence of which the present subspecies has a much brighter and cleaner appearance. This colouring is constant and is found in all the specimens from the Mijertain country. In all other respects, including the skull-measurements, it resembles *M. phillipsi*.

*Locality*.—From Eil Hur, near Obbia, in the south to Eil Lagodhey, and probably throughout the country of the Mijertain Somalis, being replaced on the coastal belt by *M. phillipsi gubanensis*, and associated in the hinterland of Obbia with *M. piacentini*.

Type-specimen collected at Eil Hur, near Obbia, Italian Somaliland (B.M. no. 11. 8, 2. 32). I have taken this specimen from my collection as the type, as neither of Major Lawrance's specimens from El Lagodhey have skulls.

# XXVIII.—*A new Race of Monkey from Annam.*

By C. BODEN KLOSS.

IN ANN. & MAG. Nat. Hist. (9) vol. ix. pp. 87-99 (1922), Mr. H. C. Robinson and the writer described a number of new mammals from Annam, French Indo-China, collected by the latter. Another form from the same locality is now distinguished:—

## *Presbytis nemæus moi*, subsp. n.

Like *Presbytis nemæus nigripes* (A. M.-Edw.), but with the black area on the sides of the head, the black nuchal collar, and the black band bordering the upperside of the white rump reduced; the black gorget narrower and less intense, the black area of the lower abdomen reduced in extent and the black of the forearm either confined to the hands or else not extending so far over the wrists.

*Type.* Adult male (skin and skull). Collected on Langbian Peak, South Annam, 5500-6500 feet, on 23rd April, 1919. No. 3516/C. B. K.

*Measurements* (external measurements taken in the flesh).—Total length 1320 mm.; tail 735; hind foot 201. Skull: greatest length 112; greatest breadth 80; alveolar length of upper molar row 32.

*Specimens examined.*—Two males, three females, and two juveniles from the type-locality, and two males from Dran, 3000 feet. Compared with two males of *P. nemæus nigripes* from Trangbom, 25 miles east of Saigon, which is the type-locality of the latter.

*Remarks.*—Though closely resembling *P. n. nigripes* of South Cochin China, the reduction in extent of the black areas distinguishes this form from South Annam, where it occurs in a mountainous area about 150 miles N.E. of the lowland type-locality of the other.

XXIX.—Description of a new Subspecies of *Hartebeeste* (*Bubalis*). By A. E. RUXTON.*Bubalis cokei ritchiei*, subsp. n.

One complete skin (♀), one skin in two pieces (♂), and the skull of each specimen have been received from Major Ritchie, Game Warden, Nairobi, Kenya Colony.

Colour of mask and skin yellower, paler but brighter, than *B. c. nakuræ*. There are no black bands bordering the hoof-clefts as mentioned in the description of *B. c. nakuræ*.

The horns cannot be described as "bracket-shaped," being more of a U-shape, with the points thrown back parallel to the centre line of the face.

Measurements of horns: length on outside curve 422 mm.; greatest breadth (at points) 247; width between horns at backward curve (inside measurement) 230; circumference at base 235.

With the skull lying face downward the horns, from tips to curves, form an angle of 45° from the perpendicular.

Skull-measurements: condylo-basal length 390 mm.; length from bifurcation of horn-pedicle to tip of premaxillæ 460; zygomatic breadth 128; nasals 208; length of upper tooth-row 94; distance from first premolar to premaxilla tip 135.

Body-measurements: length along curves over all (upper lip to end of bone in tail) 102 inches; tail (to end of bone) 16; girth of neck in front of shoulder 30; girth of neck at smallest point 20; height at shoulder 52.

*Hab.* "Southern Uasin Gishu country lying south of Kisii, west of the Amala (Mara) River, and north of the Magoro River."

*Type.* Fully adult female. B.M. no. 26. 6. 5. 2. Collected 3rd Nov., 1924, and presented by Major Ritchie.

Major Ritchie states:—"I noticed that there were animals in both herds showing slight *cokei* and also slight *jacksoni* tendencies in the horns; for the most part, however, the horns approximated closely in shape to the two obtained. There was, in fact, much less divergence (from the type forwarded) than is normally found, in my experience, in a herd of *nakuræ* hartebeeste from their type."



XXX.—*Descriptions and Records of Bees.*—CXII.

By T. D. A. COCKERELL, University of Colorado.

## ASAROPODA, gen. nov.

Characters in general those of *Anthophora*, but as in *Saropoda* the labial palpi are two-jointed, with a brush of stiff hairs at the end. The maxillary palpi are six-jointed (four-jointed in *Saropoda*), the second joint very long, the third and fourth equal, the last two small. The maxillary palpi are twice as long as in *Saropoda bimaculata*; the blade of maxilla is about 2.5 times as long as palpi, in *Saropoda* 3.5 times.

Type, *A. bombiformis* (*Saropoda bombiformis*, Smith); also includes *A. alpha* (*Saropoda alpha*, Ckll.); both from Australia. True *Saropoda* is European. The specimen of *A. bombiformis* from which the mouth-parts were extracted comes from Studley Park, Victoria (Melbourne Museum).

The joints of the maxillary palpi of *A. bombiformis* measure in microns:—(1) 175, (2) 750, (3) 255, (4) 255, (5) 120, (6) 95.

*Hylæus hobartianus* (Cockerell).

♂.—Fern Tree Gully, Victoria, Dec. 25, 1917 (Melbourne Museum).

Differs a little from the type in having the flagellum ferruginous beneath. The species has hitherto been known only by the type, collected in Tasmania.

*Melittosmithia subtilis*, sp. n.

♀.—Length about 7 mm.

Robust, head and thorax black, dullish, but the clypeus and metathorax polished; long white hair on cheeks and sides of thorax; labrum light ferruginous; mandibles long, simple, dark red, with most of the apical half black; clypeus obscure red, sharply keeled down the middle; front and mesothorax excessively closely and minutely punctured; antennæ very dark reddish, the flagellum clear red beneath; third antennal joint somewhat shorter than second, but longer than fourth; tegulæ pale testaceous. Wings hyaline, stigma and nervures ferruginous; basal nervure falling considerably short of nervulus, first recurrent meeting first intercubitus, but second ending some distance before end of second cubital cell. Legs fusco-ferruginous, anterior tibiæ light yellowish

red in front; hind tibiæ with the usual spines near base. Abdomen broad, light yellowish ferruginous, with dusky reddish transverse clouds in middle and at sides of segments, extreme apex darker; venter clear orange-ferruginous.

"Oakley L." (Melbourne Museum).

The known species of *Melittosmithia* may be separated thus:—

- |   |    |  |
|---|----|--|
| Abdomen abruptly bicoloured, the apical portion broadly black or dark brown, the basal part ferruginous ..... | 1. |  |
| Abdomen not bicoloured, but red clouded with dusky, especially at sides .....                                 | 2. |  |
| 1. Femora and tibiæ bright ferruginous; wings hyaline.....  |    | <i>carinata</i> (Smith).               |
| Legs brown, anterior tibiæ yellowish red; wings dusky .....   |    | [ <i>adelaidæ</i> , Friese).           |
|   |    | <i>adelaidæ</i> ( <i>Stilpnosoma</i> ) |
| 2. Larger (nearly 9 mm.), mesothorax very shiny, with very few punctures .....                                |    | <i>froggattiana</i> (Ckll.).           |
| Smaller, mesothorax dullish, densely and minutely punctured .....   |    | <i>subtilis</i> , Ckll.                |

I refer Friese's species here because he alludes to the roof-like clypeus; otherwise it would go in *Euryglossa*, in which the specific name is preoccupied. It is recorded from Sydney, not from Adelaide, as the name might suggest.

### *Euryglossina chalcosoma*, Cockerell.

Ringwood District, Victoria (Melbourne Museum).

*Euryglossa calliopsella*, Ckll., also comes from this locality.

### *Euryglossa walkeriana*, Cockerell.

Hobart, Tasmania (*C. E. Cole*; Melbourne Museum).

Differs from the type in having the second and third abdominal segments rufescent apically.

### *Euryglossa nitidifrons filicis*, subsp. n.

♀.—Length a little over 5 mm.

Differs from Smith's description of *E. nitidifrons* by the strongly dusky wings, stigma and nervures dark brown; fifth abdominal segment with a broad yellow band, interrupted in middle, sixth without yellow. Easily known from *E. maculata*, Sm., by the yellow basal half of mandibles. Of the large lateral spots on abdomen, the first are triangular,

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the apex directed posteriorly, the second and third are irregularly rounded. Face entirely black, shining, flagellum red beneath; recurrent nervures joining second cubital cell not far from base and apex.

Two from Fern Tree Gully, Victoria, Jan. 28, 1915 (*F. P. Spry*; Melbourne Museum).

*Binghamiella antipodes insularis* (Cockerell).

Georgetown, Tasmania (*C. E. Cole*; Melbourne Museum).

*Trichocolletes venustus* (Smith).

Hobart, Tasmania (*C. E. Cole*; Melbourne Museum).

The specimen is peculiar for having the first intercubitus entirely lacking on the right side.

*Paracolletes fulvescens* (Smith).

♂.—New Zealand (*C. French, Jr.*; Melbourne Museum).

Smith described the female. The male is about 12 mm. long, with the deep fulvous hair of head and thorax practically of one colour above and beneath; there is dark hair on vertex. The second cubital cell is greatly broadened below. *P. waterhousei*, Ckll., from Victoria, is so similar that I doubt its distinctness, but more material is desirable. I have only female *waterhousei*. Is it possible that the male just described is really *P. waterhousei*, and did not come from New Zealand?

*Paracolletes rebellis*, Cockerell.

Healesville, Feb. (*J. E. O.*; Melbourne Museum).

Someone has labelled one of these *Tetralonia brevicornis*, Sm., and on investigation I find that I was quite wrong to refer *T. brevicornis* to *Reepenia*. It must stand as *Paracolletes brevicornis* (Sm.), and is very close to *P. rebellis*. *T. convicta*, Ckll., will be *Paracolletes convictus* \*.

\* This eliminates *Tetralonia* from the Australian fauna. I have a *P. rebellis* showing the characteristic tongue and palpi of *Paracolletes*, yet it differs principally from the so-called *Tetralonia* by the darker legs. The difference in the breadth of the third cubital cell, mentioned in the description of *P. convictus*, is not constant. I find in *P. rebellis* the third cubital may be narrowed almost to a point or as broad as the second. *P. convictus* is, nevertheless, distinct; when last at the British Museum I noted that the antennæ were much longer than in male *brevicornis*. At

*Cænohalictus azaræ*, nom. nov.

When writing on *C. smaragdulus* (*Halictus smaragdulus*, Friese, 1916) from Chile ("Bees," CIX. p. 306) I omitted to note that the same specific name had been proposed for another species by Vachal in 1895. The Chilean species may be named *C. azaræ*. Herbst records it as visiting flowers of *Azara celsastrina*, D. Don.

*Halictus glabrescens*, nom. nov.

*Halictus glabriventris*, Friese, 1916; Chile (not *H. glabriventris*, Crawford, 1907).

*Halictus tertius*, Dalla Torre.

Lake Hattah, Jan. 19, 1920 (*J. E. Dixon*; Melbourne Museum).

In some the wings are very strongly fuliginous.

*Halictus lanariellus*, Cockerell.

Kewell, 12. 1. 22 (*J. Hill*; Melbourne Museum).

Seven females.

*Halictus megastigmus*, sp. n.

♀.—Length about 7 mm.

Rather elongate, head and greater part of thorax black, mesothorax shining green; legs basally black, but tibiæ and tarsi, and femora at apex, bright ferruginous, the hind tibiæ with a black stain; tegulæ red. Wings ample, slightly dusky, beautifully iridescent with green, pink, and purple; nervures brown, outer recurrent and intercubitus evanescent; third cubital cell short, shaped nearly as second; stigma very large, red, with broad dusky margins. Abdomen ferruginous, with blackish stains, first segment with a black spot at base. Head broad, facial quadrangle much broader than long; mandibles red, black at base; malar space obsolete;

Oxford I made the following notes on male *P. brevicornis* (Sm.):—knees, tibiæ, and tarsi red; face with red hair; antennæ long (but short for a *Tetralonia*), flagellum crenulate; metathorax covered with long plumose hair, except the large convex area, which has distinct channelled margin, the channel crossed at frequent intervals by little ridges; basal nervure meeting nervulus; first recurrent nervure joining second cubital cell near or beyond middle; venation not like *Nomia*.

maxillary palpi long, six-jointed, joints subequal except first, which is much shorter and stout; labial palpi with the second to fourth joints resembling those of maxillary palpi; joints 4 and 5 of maxillary and third of labial palpi produced laterally at end; maxillary blade short and broad, the oblique apical margin with about nine shining golden bristles, a suture limiting apical portion as in other *Halictines*; paraglossæ short and broad, rounded, hyaline; tongue apparently absent or missing; clypeus short, shining, with large punctures; sides of face shining, front dull, microscopically striate; antennæ black, the flagellum obscurely reddish beneath; mesothorax shining, microscopically tessellate; scutellum polished, postscutellum dull; area of metathorax very large, dull, appearing granular, but with microscopic raised lines; hind femora carrying light yellow pollen; pulvilli very large, elongate. Abdomen dullish, with the apical margins of the segments broadly shining; ventral hairs carrying some pollen.

Hobart, Tasmania, 22. i. 18 (*C. E. Cole*; Melbourne Museum).

A peculiar species, recognizable among its allies by the shining mesothorax and large stigma. A related (possibly identical) form was collected by R. E. Turner at Eaglehawk Neck, Tasmania, in 1913. The specimen, now in the British Museum, was not described because it lacked the head.

*Halictus veronicæ*, sp. n.

♀ (type).—Length about 5.5 mm.

Not very robust, shining olive-green; lower margin of clypeus broadly black, and above the black a pink band; mandibles red except at base; flagellum clear bright ferruginous beneath; mesothorax and scutellum strongly suffused with coppery red. Legs black, with knees, anterior and middle tibiæ except a dark spot, hind tibiæ at base and extreme apex, and the tarsi all bright ferruginous. Abdomen with hind margin of first segment slightly red, and very broad ferruginous bands at the apices of the others, including also the overlapped base of the one beyond; apex red; venter red, with three greenish bands. Head small, ordinary; mesothorax and scutellum highly polished, well punctured; area of metathorax dullish, with fine dense wrinkled ridges; tegulæ testaceous. Wings hyaline, very faintly dusky, stigma amber-colour, nervures pale; outer recurrent and intercubitus very faint. Abdomen shining, the punctures

very minute; a little thin pruinose pubescence, but no hair-bands or patches; no ventral pollen-collecting scopa. Hind spur with a long spine or tooth.

♂.—Smaller; middle of mandibles, labrum, and lower end of clypeus light yellow. Head ordinary, not enlarged; flagellum of the usual length for male *Chloralictus*; thorax above shining olive-green, without the coppery colour. Abdomen green, without the red bands or venter, but apex light red. Femora distinctly metallic; anterior tibiæ pale red, whitish at ends; the other tibiæ dark, with narrowly light ends; tarsi pale yellow, reddened apically.

Sandringham, Victoria; the sexes mating on garden *Veronica*, Feb. 28, 1926 (*T. Rayment*).

A distinct species of the subgenus *Chloralictus*, related to *H. purnongensis*, Ckll., but with small head in the male and differently coloured abdomen.

*Nomada putnami*, Cresson.

Mr. Chas. H. Hicks has found the male at Boulder, Colorado, June 13.

It runs in my table (Proc. Philad. Acad. 1903, p. 609) nearest to *N. crassula*, Ckll., differing thus:—Supraclypeal mark present; face bright yellow below antennæ, lateral marks at upper end receding from orbits; third antennal joint much longer than fourth; apical plate of abdomen deeply notched.

*Nomia submærens*, Cockerell.

Hobart, Tasmania (*C. E. Cole*; Melbourne Museum).

*Nomia australica*, Smith.

At Sandringham, Victoria, Mr. Rayment finds it only at flowers of *Coreopsis* and *Hypochaeris radicata*. Broad Meadows, Jan. 27 (Melbourne Museum).

*Nomia frenchi*, Cockerell.

A male from Woodend, Victoria, is in the Melbourne Museum.

*Nomia melanodonta*, sp. n.

♂.—Length 9 mm. or a little over.

Black, with anterior and middle knees, their tibiæ in front

and at end, hind tibiæ except a dusky patch on outer side, and all the tarsi ferruginous; antennæ long; scutellum bigibbous; face covered with white hair; tongue sharply pointed, of moderate length. Wings broadly dusky on apical margin; stigma dark red; second cubital cell rather broad.

This has exactly the appearance of *N. frenchi*, Ckll., but is certainly distinct by the following characters:—Flagellum bright ferruginous beneath, dark red above; hind tibiæ sub-trigonal, with a prominent apical anterior broadly truncate lobe, hence broader at end than in middle; fourth ventral segment of abdomen deeply emarginate, and from the emargination proceeds a polished sharp black tooth. In *N. frenchi* the hind edge of this segment is merely slightly concave, and there is no tooth; it may be called shallowly emarginate. In both species the hind femora are swollen.

Wodonga, Victoria (Melbourne Museum).

*Megachile latipes*, Smith.

♂.—Described from "New Holland." A specimen in Melbourne Museum is from New South Wales.

The sixth abdominal segment has the projecting margin very broadly shallowly emarginate.

*Megachile phenacopyga*, Cockerell.

♂.—Broad Meadows, Victoria (Melbourne Museum). I have a male from S.W. Australia (*Turner*) from the series which Meade-Waldo referred to *M. chrysopyga*, Smith. The male described as *M. chrysopyga* by Smith is different, as I have shown in Journ. N.Y. Ent. Soc. 1910, p. 109. It is, however, possible that Smith did not associate the sexes correctly. I have described a female which I considered *M. phenacopyga*, and it was not *M. chrysopyga*.

*Megachile victoriæ*, Cockerell.

♂.—Bayswater, Victoria (Melbourne Museum).

The specimen evidently belongs here, but it shows a large orange-red hair-patch at end of abdomen, covering fifth segment except sides, and slightly invading fourth and sixth. The mandibles are tridentate, with two apical teeth and a long sharp inner tooth at right angles to mandible. The species is closely allied to *M. tomentella*, Ckll., differing by

flagellum dusky red beneath, and well-developed white hair-bands, broadly interrupted in middle, on abdominal segments 1 to 3. It is smaller than *M. tomentella*.

*Exoneura hamulata*, Cockerell.

♂.—Georgetown, Tasmania (*C. E. Cole*; Melbourne Museum).

Not typical, but agrees with the form taken at Bridport.

*Dianthidium arenarium* (Ducke).

*Anthidium arenarium*, Ducke.

Brazil.

I found it in British Museum, and noted: very small, second recurrent going much beyond outer intercubitus, pulvilli present.

*Dianthidium latipes* (Bingham).

*Anthidium latipes*, Bingham.

Burma.

Second recurrent much beyond outer intercubitus, pulvilli present.

*Hypanthidium malacopygum* (Gribodo).

*Anthidium malacopygum*, Gribodo.

Algeria.

I found one in British Museum. Small, superficial appearance of *A. strigatum*, second recurrent going beyond outer intercubitus, no pulvilli.

*Hypanthidium orientale* (Bingham).

*Anthidium orientale*, Bingham.

Tenasserim. Second recurrent beyond outer intercubitus, no pulvilli.

*Xylocopa iridipennis*, Lepelletier.

A male from Bangkok, Siam (*H. M. Smith*), has the yellowish-white lunules enclosing the middle ocellus, said by Bingham to be absent. Dr. Smith finds this and *Mesotrichia latipes* (Drury) common in Bangkok gardens.



*Trigona cambodiensis*, sp. n.

Worker.—Length 5·7 mm., anterior wing 6·3 mm.

Black, shining throughout, with mainly black hair, but thin and brownish white on face and most of front, sordid white at sides of prothorax and below wings; mandibles red, with two sharp teeth at inner apical corner; clypeus with an obtuse median keel, its lower margin narrowly pale reddish; scape clear red, apically black above; flagellum black above, beneath pale yellowish red, with the sutures more or less dark; mesothorax polished; tegulæ black. Wings very dark fuliginous as far as level of middle of stigma, beyond that milky white, apical half of stigma light ferruginous. Anterior basitarsi red-haired on inner side; last joint of each tarsus red; hind tibiæ much broadened, the hind margin greatly curved. Abdomen rather narrow.

Four, Angkor Wat, Cambodia, Jan. 11, 1926 (*H. M. Smith*).

This may have been included by Bingham under *T. vidua*, Lep., though he says "head and thorax dull and opaque." The original *T. vidua* came from Timor and has the antennæ blackish brown. Another related species is *T. reepent*, Friese, from Upper Perak, which is shining, but has the clypeus and tarsi reddish yellow. Dr. H. M. Smith sends me an interesting account of the habits of *T. cambodiensis*, as follows:—

"On the side of a fallen block of stone on the portico of one of the larger libraries at Angkor Wat there was observed a white wax tube, 1·1 cm. in diameter, projecting 10 cm. above the surface of the stone and attached to the side of the stone throughout the remainder of its length of about 30 cm. The upper 15 cm. of the tube was perfectly cylindrical and had a thin, granular, fragile wall; the next 15 cm. was slightly dilated, the widest part being 2 cm. in diameter, and below gradually merged into the lowest section which tapered to a dull point. The dilated portion contained chambers. The bees were active, non-buzzing, and non-pugnacious. Not more than twelve or fifteen were seen at any one time, and these after the tube had been inadvertently crumbled at its upper end the excited bees hovered about it."

*Anthophora asserta*, sp. n.

♂ (type).—Length about 11 mm.

Black, with the clypeus (except a narrow curved stripe on

each side), supraclypeal band with upward extension in middle, lateral face-marks squarely cut off at level of upper end of clypeus, labrum except small basal spots, mandibles except apex, and broad stripe on scape all pale yellow; eyes reddish brown; flagellum black, faintly reddish beneath; hair of cheeks and thorax beneath white, of thorax above and vertex pale fulvous mixed with black; tegulæ ferruginous. Legs with black and white hair, on hind basitarsi all black. Abdomen with five dull greenish-white hair-bands, sixth segment black, with a little pale hair on each side; fifth ventral segment very deeply emarginate.

♀.—Length nearly 13 mm.

More robust; band on middle of clypeus, coming to a slender point above, very narrow transverse subapical band, lower corners of clypeus broadly, lateral marks consisting of bands along sides of clypeus, supraclypeal mark, labrum, most of mandibles, and mark on scape all pale yellow; flagellum dark; hind basitarsus with a tuft of white hair at base. Abdomen with four light blue bands, fifth segment with a tuft of white hair in middle and much white hair at sides. This female seems to belong with the male, but the association is not absolutely certain.

3 ♂, Lower Fern Tree Gully, Victoria, Jan. 22, 1916 (*Master A. Burns*); 1 ♀, Canterbury, 1. vi. 21 (*C. French, Jr.*). Melbourne Museum.

This looks like *A. pulchra*, Smith, and I was much surprised to find it distinct. The males will be known by the conspicuous black hairs on vertex and front, the broader face, the deeply emarginate fifth ventral segment, and entirely black-haired hind tarsi. In the female the abdominal bands are narrower and bluer than in *A. chlorocyanea*, Ckll. The female would be included in what has passed as *A. zonata* (L.) in Australia, but it is not the true *A. zonata*.

NOTE.—The bees collected by R. C. McGregor in Palawan (no. 6897) at flowers of grass were, as he now tells me, at *Andropogon aciculatus*, Retz.

### *Stelis callura*, Cockerell

♂.—Brainerd Lake, Boulder County, Colorado, July 26, 1925 (*C. P. Custer*).

New to Colorado; described from Utah.

*Halictus subinclinans*, Cockerell.

Sandringham, Victoria (*Rayment*).

This was described from Tasmania. The material from Victoria varies in size, but is distinctly *H. subinclinans*. Possibly it will be found to intergrade with *H. inclinans*, Smith.

*Halictus victoriellus*, Cockerell.

Mr. Rayment sends a series from Sandringham, Victoria, and I conclude that the material from that vicinity which I formerly took for a variety of *H. pulvitectus*, Ckll., is all *H. victoriellus*.

*Halictus asperithorax*, Cockerell.

Sandringham, Victoria (*Rayment*, 14).

Not quite typical, but evidently this species. It was captured on flowers of *Veronica*, December 23.

*Halictus leucorhinus*, sp. n.

♂.—Length about or rather over 10 mm., anterior wing 8.3 mm.

Black, head and thorax with rather loose, long, dull white hair; head broad, eyes converging below; malar space distinct; clypeus prominent, exposed, the black basal half punctured; the apical half (with a pointed extension upward in middle line) white, smooth, very sparsely punctured, depressed in middle; the lower margin black; front dull, but a shining area round middle ocellus; antennæ entirely black, very long, reaching to hind border of scutellum, the long flagellar joints submoniliform; mesothorax finely, densely, more or less confluent punctured, on disc posteriorly shining between the punctures; scutellum shining, bigibbous; area of metathorax rather large, with coarse radiating rugæ, the margin swollen but not polished; tegulæ black, with reddish spot and pallid margin. Wings faintly dusky, stigma rufous, nervures piceous; second cubital cell nearly square, receiving recurrent nervure a short distance before its apex; third cubital cell very broad above. Legs black, with white hair, pale yellowish on inner side of tarsi; spurs very pale. Abdomen shining, the first two segments finely and rather closely punctured; there is a thin clothing of white hair, longest and most conspicuous at sides, and slight basal bands at sides of second and third segments; apex broadly truncate.

Sandringham, Victoria, Jan. 26, 1926, at flowers of garden

*Veronica* (Rayment, 22). Mr. Rayment states that he also observed it on garden *Gaillardia*, Dec. 17, and *Veronica*, Feb. 6.

I tried to associate this large and conspicuous male with some described female, but without success. It is very like *H. eboracensis*, Ckll., but has the wings darker, veins darker and heavier, and first recurrent joining second cubital cell some distance from end (meeting intercubitus in *eboracensis*).

*Halictus niveifrons*, Cockerell.

Sandringham, Victoria (Rayment, 28).

Previously known from Tasmania.

### XXXI.—Notes on some African Derbidæ (*Homoptera*).

By F. MUIR.

THE specimens dealt with in this paper were received, with other material, from Dr. Guy A. K. Marshall, C.M.G., F.R.S., Director of the Imperial Bureau of Entomology. Although only sixteen species have been treated as yet, all except four have had to be considered as new. The records of food-plants are of interest, and it is to be hoped that collectors will continue to make such records; palms in Africa appear to be as attractive to Derbidæ, especially the Zoraidini, as in Asia, Malay Islands, and Australia. The eggs of this family have never been recorded; they are evidently laid in rotten wood or under old bark, for that is where the nymphs are to be found.

#### *CENCHREINÆ.*

#### CENCHREINI.

#### *CEDUSA*, Fowler.

#### *Cedusa natalensis*, sp. n. (Fig. 1.)

*Female*.—Length 2 mm., tegmen 3·6 mm.

Subantennal process and shoulder-keels well developed, the former longer than broad; no median carina on frons; tegmina typical.

Shiny yellow; pronotum lighter; front and middle tarsi slightly fuscous; abdomen brown, with pale pleura and pale on hind margin of sternites, genitalia lighter. Tegmina hyaline, slightly fuscous, more so over apical and subapical

cells; veins lighter. Wings hyaline, very slightly fuscous; veins darker. Hind margin of pregenital plate angularly produced.

Described from one female.

NATAL: Weenen, xii. 1923 (*H. P. Thomasset*).



*Cedusa natalensis*.

Hind margin of pregenital plate.

Three species of this genus are reported from Africa, namely: (*Lamenia*) *angustifrons*, Mel., and (*Lamenia*) *lactea*, Mel., from East Africa; and (*Herpis*) *aburiensis*, Muir, from the Gold Coast. The two former have a median longitudinal frontal carina and the last has the subantennal process broader than long.

#### PHENICE, Westw.

##### *Phenice fasciolata* (Boh.).

Three female specimens from Sembehun, Shenge, and Songo, Sierra Leone (*E. Hargreaves*), which appear to be this species.

#### PARAPHENICE, Muir.

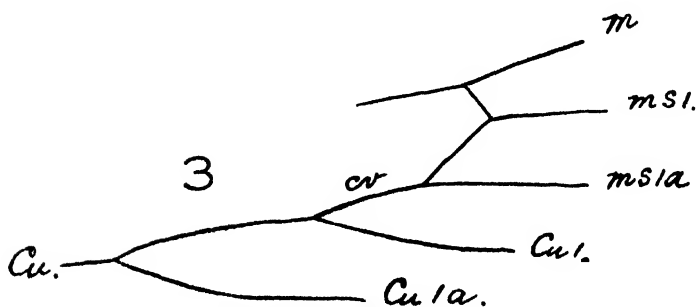
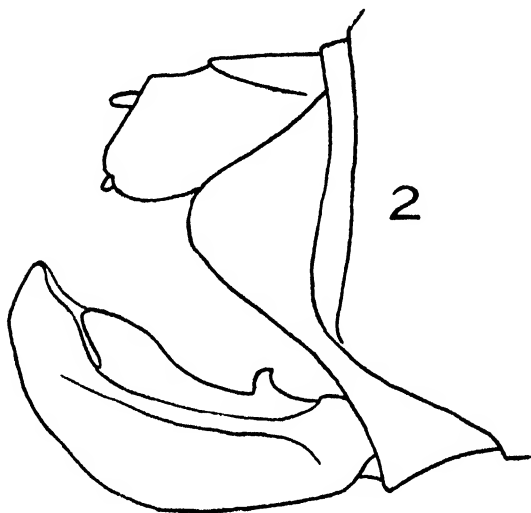
##### *Paraphenice sierraleonensis*, sp. n. (Figs. 2, 3.)

*Male*.—Length 2.9 mm., tegmen 5.7 mm., wing 4 mm.

Length of antennæ 1.5 the width, about half the length of the frons. Five median sectors, the first or basal sector apparently not forked, the branch having been captured by the cubital system, which appears as three-branched. The male genitalia are close to those of *P. neavei*, but the genital styles are not so broad and more pointed at the apex; the æoæagus also appears to differ considerably.

Head, antennæ, and legs yellow; pronotum light in middle and on sides, dark between; mesonotum brown with lighter carinæ; abdomen darker brown, genitalia lighter. Tegmina fuscous with hyaline or semihyaline spots and marks, the infuscation darkest over base of clavus and at the apex of *M*, where there is a black mark over base of apical *M* sector; the lighter marks are: five or six in costal cell, along second claval vein, from apex of clavus to *M*, near base of each *M* sector, a pair between each *M* sector, one on each side of

the graduate cross-veins, the basal portion of *R* cell light and two light spots in apical portion; veins dark brown, *R* and *M* slightly red. Wings fuscous with dark veins. A waxy secretion over the body, tegmina, and wings gives an appearance of "bloom" and a bluish tinge on the darker surfaces.



*Paraphenice sierraleonensis*.

Fig. 2.—Lateral view of male genitalia.

Fig. 3.—Cubital system of tegmen.

*Female*.—Similar in build and colour to male, but the antennæ are smaller. The genitalia are close to those of *P. neavei* and have a small pointed process on each side of the eighth segment.

Described from one male and one female.

SIERRA LEONE: Mosokobi, 27. ix. 1924, on oil-palm (*E. Hargreaves*).

There are five female specimens of this genus representing perhaps four species collected by Mr. E. Hargreaves in Sierra Leone, all closely related to the above. The writer does not feel disposed to describe them without the males.

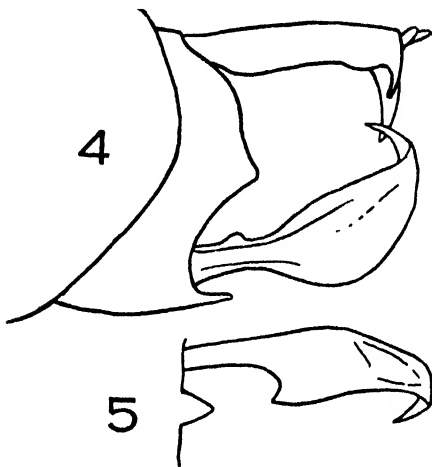
#### OTIOCERINI.

##### KAMENDAKA, Distant.

*Kamendaka albomaculata*, sp. n. (Figs. 4, 5, 6.)

*Male*.—Length 2·3 mm., tegmen 4·6 mm.

The junction of frons and vertex making an angle of



*Kamendaka albomaculata*.

Fig. 4.—Lateral view male genitalia.

Fig. 5.—Ventral view left genital style.

about 100 degrees (subgenus *Eosaccharissa*), apical portion of frons in profile not greatly curved.

Head and pronotum stramineous or light brown; mesonotum darker brown with lighter carinae; abdomen still darker brown; legs stramineous. Tegmina fuscous brown, with hyaline spots which are generally covered with a thick, white, waxy secretion; the membrane covered with a thin waxy secretion, which gives it a bluish tinge. The white spots are: five in costal cell, the largest at node with a red vein through it, one distinct and one indistinct in basal median and in basal cubital cells, three small ones in clavus,

one in *Cu* fork, a larger one over base of first *M* sector, two in *Sc* apical cells, one larger one at apex of *R* apical veins and a smaller one at base of *R* apical cell, a small apical one between *M* sectors 3 and 4, a larger one over the apical cells of *R* sector 2, and one in each of the *C* apical cells; veins mostly red, especially the *Sc*, *R*, and *M*. Wings uniformly fuscous with dark veins.

The anus at apex of anal segment, the apical corners produced and turned ventral, the right longer than the left; genital styles broad, thin, convex on outer surface, concave on inner, apex acute, turned inward.

*Female*.—Similar to the male. The pregenital plate is subangulately produced in middle.

Described from twenty-one specimens.



*Kamendaka albomaculata*.

Hind margin of pregenital plate.

SIERRA LEONE: Madonke, Bompatuk, Kennema, Sama, Njala, Songo, and Sembahun, on fern, *Pandanus* sp., guava and oil-palm, the greatest number on fern (*E. Hargreaves*).

ROBIGUS, Distant.

*Robigus tortrinotatus*, sp. n. (Figs. 7, 8, 9, 10, 11.)

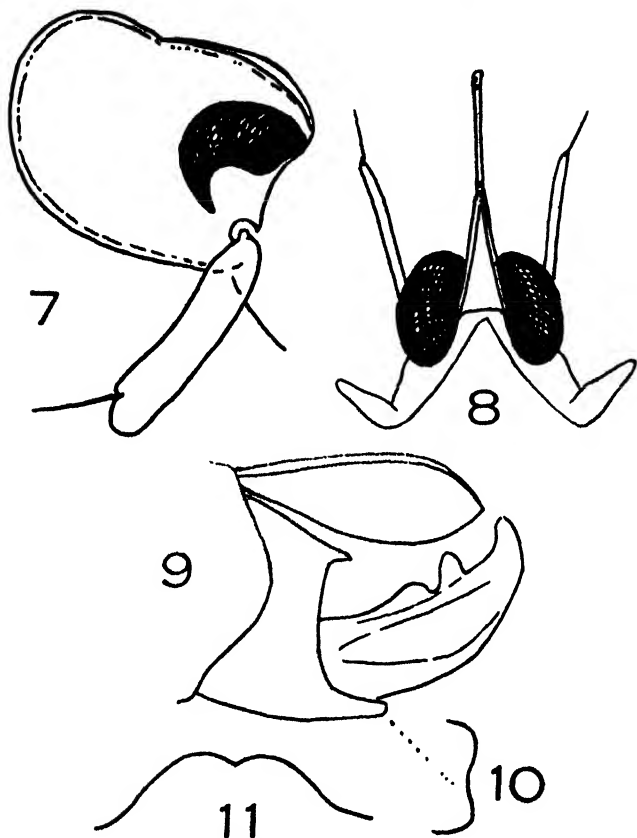
*Male*.—Length 3 mm., tegmen 5.3 mm.

*Sc* and *R* joined to near stigma, subcostal cell short, *M* joined to *Sc* + *R* near the base, *Cu* fork closed about level with stigma with four *M* sectors beyond. Head laterally very thin, especially in front, in lateral view longer than deep; vertex acutely angular. Antennæ not quite so long as head, flattened, fairly wide, arista at apex. Anal angles of pygofer produced into a small point, ventral margin widely produced, the margin of the production sinuous. Anal segment concave dorsally, convex ventrally, the anus sunken into the dorsal concavity; genital styles large, inner margin entire, convex, outer margin produced into two small rounded processes, apex narrowly rounded.

Yellow, the legs lighter; the abdomen greenish; a scarlet band from middle of frons to eyes, antennæ and greater portion of clypeus scarlet; a scarlet line from behind eyes, over pronotum and mesonotum, and continued as a zigzag line to first *M* sector where it branches, one branch going



to margin near stigma and the other along first *M* sector, where it meets a scarlet line from hind margin to apical *Rs*; scarlet over apical *M* sectors 1-3; veins same colour as membrane. Wings white with white veins.



*Robigus tortrinotata*.

- Fig. 7.—Lateral view of head.  
 Fig. 8.—Dorsal view of head and pronotum.  
 Fig. 9.—Lateral view of male genitalia.  
 Fig. 10.—Ventral margin of pygofer.  
 Fig. 11.—Hind margin of pregenital plate.

*Female*.—Length 4.4 mm., tegmen 6.9 mm.

The antennæ are thicker and more typical than in the male, otherwise similar in build and colour. The hind margin of pregenital plate figured (fig. 11).

Described from one female and one male.

NYASALAND : Palombe, 20.iii.1924 (*C. Smee*) ; Chiromo (*R. C. Wood*).

This is the first of the *Nicerta-Robigus* group to be reported from Africa, although the writer has seen other specimens. The short subcostal cell places it in *Robigus* or *Leptaleocera*, and the antennæ are not typical of either. The shape of the head varies greatly in these species and cannot be used for generic distinction without confusion, and the same can be said of the antennæ.

#### RHOTANINI.

LEVU, Kirkaldy.

*Levu africana*, sp. n.

*Male*.—Length 2.6 mm., tegmen 4.6 mm.

The shoulder-keels are well developed, the face linear with the lateral carinæ in contact to near apex, the vertex very small and triangular ; the tegmen has a triangular cell at the base of the first median sector. The lateral margins of the pygofer produced into an acute angle in middle ; ventral margin straight. Anal segment about as long as broad, ventral surface concave. Genital styles longer than broad, inner margin convex, outer margin nearly straight, apex broadly rounded, narrow at base, a small curved spine near base on outer margin.

Stramineous ; tegmina hyaline, opalescent ; veins slightly fuscous over base of second *M* sector, across the veins to cubitus on posterior margin ; the gradate apical veins fuscous ; a small fuscous mark in middle of costal cell. Wings hyaline, slightly opalescent, veins light brown.

*Female*.—Similar to the male, but the infuscation on *Cu* a little darker. The posterior margin of pregenital plate roundly produced in the middle.

Described from one male and one female.

SIERRA LEONE : Kenuema, xii. 1924 (*E. Hargreaves*).

This is the first of the *Rhotana* group to be reported from Africa.

#### Zoraidinæ.

#### ZORAIDINI.

PROUTISTA, Kirkaldy.

*Proutista fritillaris* (Boh.).

One male and three females from Banti, Matin, Kuelu and Kigbal, Sierra Leone (*E. Hargreaves*). The female from Banti bears a large sac of a Dryinid parasite.

*Ann. & Mag. N. Hist.* Ser. 9. Vol. xviii. 16

*LYDDA*, Westwood.

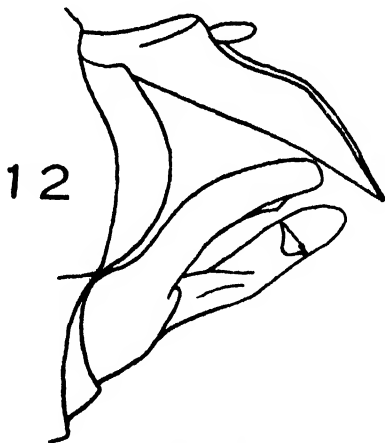
This genus can be distinguished from *Proutista*, *Camna*, and *Diostrombus* by its wider head, as wide as or slightly narrower than the thorax, but never so narrow as in the other three genera; it comes nearer to the latter two genera than to the former and it may eventually be difficult to keep them apart.

Westwood's change of generic name from *Lydda* to *Diospolis* cannot be maintained.

*Lydda annetti* (Muir).

*Diospolis annetti*, Muir, Ent. Mo. Mag. (3) iv. 1918, p. 176.

One female from Njala, Sierra Leone, on oil-palm, 23. i. 1925 (*E. Hargreaves*). One female was formerly known from Nigeria.



*Lydda cocos*

Lateral view of male genitalia.

*Lydda cocos*, sp. n. (Fig. 12.)

*Male*.—Length 2.8 mm., tegmen 6.5 mm., wing 2.2 mm.

Vertex and frons slightly narrower than in genotype, the frons moderately excavate, a distinct transverse carina dividing frons from vertex. First median sector free from *Cu* except for two distinct cross-veins. Anus about one-third from base of anal segment, apical two-thirds in section

V-shaped, pointed; lateral margins of pygofer rounded. Genital styles thin, fairly narrow, apex rounded; a little before apex on inner surface a small, angular, transverse carina.

Yellowish with a red tinge; some round fuscous spots on fourth and fifth abdominal tergites; legs nearly white, apical tarsal joint fuscous. Tegmina clear hyaline, costal and subcostal cells slightly stramineous, veins fuscous; wings hyaline, slightly fuscous along apical and hind margin, veins fuscous.

Described from one male specimen.

SIERRA LEONE: Bompatak, on coconut-palm (*Cocos nucifera*, L.), 31. vii. 1924 (*E. Hargreaves*).

*Lydda lineatipes*, sp. n.

*Female*.—Length 2·8 mm., tegmen 7 mm., wings 2·3 mm.

Head as broad as or broader than the thorax; vertex and frons typical; lateral carinæ of clypeus faint, sides slightly rounded. Pregenital plate not projecting posteriorly.

Apical segment of labium and the clypeus black or fuscous, the rest of the head and the antennæ yellow; pronotum yellowish in middle and on lateral margins, fuscous between; mesonotum fuscous, yellow in middle of anterior portion and on hind margin; mesoscutellum fuscous. Legs light yellow or whitish, front and middle femora with a longitudinal fuscous line, tarsi fuscous. Abdominal tergites black with light hind margins; tergites and pregenital plate fuscous; genital area yellowish. Tegmina hyaline, opaque with white waxy secretion, veins brown, darkest on C and R. Wings hyaline, opaque with waxy secretion, veins fuscous.

Described from one female.

SIERRA LEONE: Njala, 23. i. 1925, on oil-palm (*E. Hargreaves*).

*Lydda woodi*, sp. n.

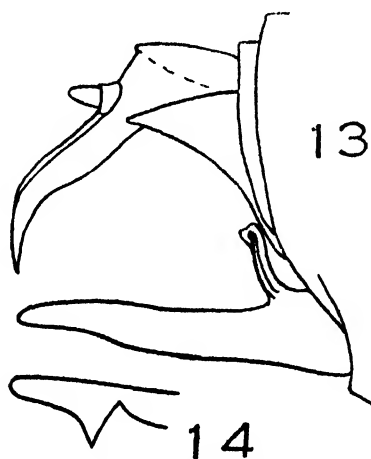
*Female*.—Length 2·9 mm., tegmen 6·9 mm., wing 2·3 mm.

Head as wide as or slightly wider than the thorax; vertex and frons typical. Mesonotal carinæ distinct. Pregenital plate large, often withdrawn into the preceding segments; posterior margin angular, sinuous, projecting beyond the reduced genitalia; anal segment very small, two small processes below it.

Apical segment of labium, clypeus except the middle of base, genæ around antennæ, black, the rest yellow; pronotum yellow in middle and on lateral margins, rest black with a few minute whitish marks along lateral carinæ; mesonotum yellow between carinæ with two black spots in middle, lateral portions black; legs yellow, with the tarsi fuscous apically. Abdominal tergites yellow in middle with small dark spots on the sides, black between with some yellowish spots; sternites and pregenital plate yellow, black across the fourth, fifth, and sixth sternites. Tegmina hyaline, clear, veins light brown or yellow, fuscous over base of costa, base of median sectors, over cross-veins and at fork of claval veins. Wings hyaline, fuscous across base and over apex, cross-veins fuscous, veins slight.

Described from four incomplete females.

NYASALAND: Chiromo (*R. C. Wood*); Ruo, 2. iv. 1915 (*R. C. Wood*).



*Lydda hargreavesi*.

Fig. 13.—Lateral view of male genitalia.

Fig. 14.—Apex of genital style, ventral view.

*Lydda hargreavesi*, sp. n. (Figs. 13, 14.)

*Male*.—Length 3.3 mm., tegmen 5.25 mm., wing 2 mm.

Head as wide as or slightly wider than the thorax, clypeus with rounded sides, lateral carinæ indistinct.

Light greenish yellow, which in life may have been more pronounced green; legs lighter, front and middle tibiae

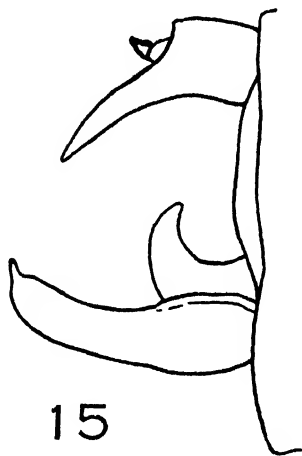
yellowish, tarsi fuscous; apical segment of labium fuscous; fourth and fifth abdominal sternites fuscous or black, a black dot on the pleura of the eighth abdominal segment. Tegmina hyaline, slightly pink opalescent; veins dark brown or fuscous, a small fuscous mark at apex of clavus; wings hyaline, veins brown or fuscous, fuscous on apical margin. Apex of wing not very acute. There is much waxy secretion over pronotum, mesoscutellum, frons, clypeus, and thoracic pleura.

*Female*.—Similar to male. Anal segment small; a pair of small genital processes with two small processes below them.

Described from seven males and five females.

SIERRA LEONE: Njala, 23.i. 1925, on oil-palm (*E. Hargreaves*).

Some specimens have more dark markings on the abdomen than the type, there being one more abdominal sternite fuscous and a number of small fuscous spots on tergites.



*Diostrombus nitidus*.

Lateral view of male genitalia.

### DIOSTROMBUS, Uhler.

*Diostrombus nitidus*, sp. n. (Fig. 15.)

*Male*.—Length 2.7 mm., tegmen 6.5 mm., wing 1.9 mm.

Bright shiny red; lateral portions of pronotum white or yellowish; tarsi slightly fuscous, tibiae darker red or very

slightly fuscous ; a small black spot in the middle of the sixth abdominal tergite, a large black spot on each lateral margin of the fifth abdominal tergite, a thin black line across the fifth abdominal sternite ; apical segment of labium black. Tegmina hyaline, shiny, opalescent with a greenish lustre ; costal and subcostal cells reddish ; margin fuscous, darker on basal half, *Sc* and *Sc + R* red, *R* broadly fuscous, a small fuscous spot in middle of costal cell, the other veins red or yellowish. Wings hyaline, slightly reddish, apical and hind margin fuscous, a small black spot in middle.

Anal segment subparallel-sided to anus, then produced to a point, anus about middle. Genital styles small, narrow, with the apex obtusely pointed and incurved ; the outer margin at base produced into a curved, flattened, pointed process.

*Female*.—Similar to male in colour and build ; genitalia abortive.

Described from two males and seven females.

SIERRA LEONE : Njala, 23.i.1925, on oil-palm (*E. Hargreaves*).

There is a slight variation in the colour, some specimens being more yellowish than others and the black marks on the abdomen not so plain.

The writer has not seen the description of *D. apicalis* (Hagl.), so there is a possibility of its being the same. The species of this genus are very similar to one another in build and colour, and the male genitalia will have to be relied upon for final identification in some cases.

### HELCITA, Stål.

#### *Helcita wahlbergi* (Stål). (Fig. 16.)

One male specimen from Njala, Sierra Leone, on oil-palm, 23.i.1925, and one female from Kennema, Sierra Leone, 16.xii.1924 (*E. Hargreaves*). This species was previously known only from South Africa and only by females ; the Sierra Leone female agrees with those from South Africa, but a male from the latter country is required for confirmation of this determination.

The male is similar to the female in build and colour, having, if anything, a little more marking on the tegmina than in the type-specimen. The anal segment is long and produced to a subacute point at the apex ; the genital styles

are broad, the basal half of the outer margin produced subquadrately, the apex pointed and curved inward.

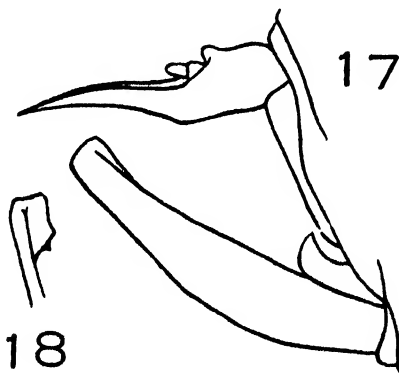


*Helcita wahlbergi*.  
Lateral view of male genitalia.

CAMMA, Distant.

*Camma lutea*, sp. n. (Figs. 17, 18.)

*Male*.—Length 2.5 mm., tegmen 6.1 mm., wing 2.4 mm.  
Head distinctly narrower than thorax; three distinct



*Camma lutea*.

Fig. 17.—Lateral view of male genitalia.

Fig. 18.—Apex of genital style, ventral view.

mesonotal carinæ. Apex of wings acute. Frons narrow, fairly deeply excavate down middle; clypeus fairly short,



wide at base, sides rounded, lateral carinæ obscure. Anal segment long, anus in basal half, apical half produced to an acute point; lateral margins of pygofer straight; genital styles long, narrow, apex truncate, a stout curved spine on base of outer margin, the inner surface of apex produced into a thick quadrate flange running longitudinally.

Yellow, darker yellow or golden over abdomen; apical segment of labium fuscous; front and middle femora fuscous on front and apical portion, front and middle tibiæ and tarsi black, hind tibiæ with a fuscous mark at apex; a white waxy secretion on pronotum, base of clypeus, mesoscutellum, and thoracic pleura. Tegmina hyaline, slightly opalescent and pinkish, veins brown, the *C*, *Sc + R*, and *R* darker than the rest; wings hyaline, the margins and veins broadly fuscous.

Described from one male.

SIERRA LEONE: Njala, 23.i. 1925, on oil-palm (*E. Hargreaves*).

#### SIKAIANINI.

##### SIKAIANA, Distant.

##### *Sikaiana africana*, sp. n.

*Female*.—Length 2 mm., tegmen 4.8 mm., wing 2.2 mm.

The basal median cell reaches nearly to the middle of tegmen. The labium is exceedingly short.

Sordid greenish yellow or white, antennæ darker. Tegmina white, opaque, a black band from apex of clavus across base of first median sector to costa; a black mark at apex of *Sc* and *R*; a minute black speck on each side of the apex of each median sector; a few minute specks from middle of clavus to costa, and a couple nearer to base; veins white, a few red spots along costa. Wings white, opaque, a minute black mark in middle on posterior margin.

Anal segment fairly large, apex rounded, anus in middle; the eighth segment angularly produced on sides of genital area; styles very small.

Described from one female specimen.

GOLD COAST (*G. S. Cotterell*).

This is the first species of this genus, or of the Sikaianini, to be reported from Africa, but the writer found one in Natal in 1901 or 1902. The genus has been reported from North America under *Euklastus*, Metcalf, and the writer has a specimen from South America, so the tribe appears to be more widely distributed than the Zoraidini.

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XXXII.—*Additions to the Marine Fauna of St. Andrews since 1874.* By Prof. M'INTOSH, M.D., LL.D., D.Sc., F.R.S., &c., Gatty Marine Laboratory, St. Andrews.

In the 'Annals and Magazine of Natural History' for 1874† and subsequently a series of articles on the Marine Fauna and Fishes of St. Andrews were contributed by the author, who then was at Murthly in Perthshire, and dependent on the kind efforts of relatives in St. Andrews for continued aid in this respect. Since 1882, however, as occupant of the Chair of Natural History in the University of St. Andrews, Director of the University Museum and of the first Marine Laboratory in Britain till 1917, additional facilities for increasing our knowledge of the Fauna of this prolific Bay were available, with the following results. Much yet remains to be accomplished faunistically in certain groups, and the structure and physiology in most present ample fields for future workers, whilst the researches of Prof. Austruther Lawson and Prof. M. Drummond on the Marine Algæ give but a hint of the extensive field, the rich tidal region, and the vast swarms of the pelagic types, such as *Rhizosolenia*, offer to the Botanist‡.

† Ser. 4, vol. xiii. p. 140.

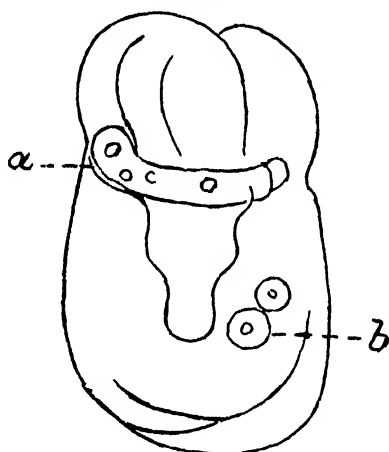
‡ The fine reference-collection of Mrs. Alfred Gatty with accompanying works were presented by her daughter, Mrs. Ede, to the Gatty Marine Laboratory, and offer considerable facilities to researchers in Marine Algæ.

In the busy life from 1882 to 1917 there was often little time for making sketches and descriptions, but as far as possible notes and outlines of interesting additions to the Fauna were kept, though the further history could not be followed, especially as the study of the food-fishes was the main task.

*Unknown Larvæ.*

On June 24th, 1890, a peculiar larva (text-fig. 1) was obtained in the bottom-net. It was somewhat ovate in outline, slightly lobate and dimpled in front, and with a blunt

Text-fig. 1.



Enigmatical larva of June 24, 1890.

central chamber terminating a considerable distance in front of the posterior end. About a third from the anterior end a transverse process (*a*) like a vascular ring occurred, which was ciliated, as also was the edge externally. Cilia also appeared at *b*. In the belt or ring (*a*) a few globular corpuscles floated all round. The investment of the body presented minute processes (like pores or canals), though they may only have been cuticular differentiations.

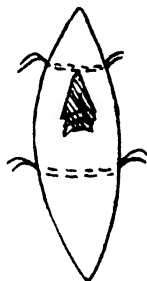
At first it was thought to be Cœlenterate, but this was uncertain. In general form it also approached an Auricularian.

Another unknown larva (text-fig. 2) having a short spindle-shaped body, with two belts of cilia, occurred in the

bottom-net on February 23rd, 1905. A pinkish triangular mass was situated a short distance from the anterior end. It may be an annelidan larva.

An enigmatical (Cœlenterate) larval form (text-fig. 3), procured in the bottom-net on December 10th, 1888, off the

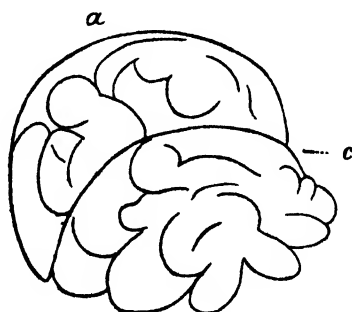
Text-fig. 2.



Unknown larva (Annelidan?).

pier, had a rounded end (*a*) of more consistent shape than the rest, as if enveloped in a capsule or sheath, whilst the lobate region behind gave it a semblance to a minute *Priapul*us. The ciliated ring followed the line *c*, and is very evident at the sides. The folded internal parts were

Text-fig. 3.



Enigmatical larva of December.

the seat of constant changes of form, and the lobate processes were elongated and shortened.

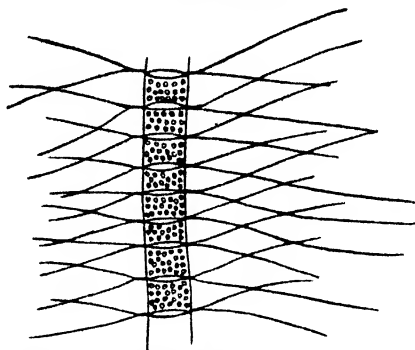
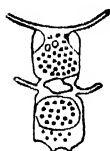
The algæ, both littoral and off-shore, are in great variety. Those in the Bay (text-figs. 4 *a*, *b*, & *c*) have as yet received scanty attention, but the littoral forms have been the

ject of careful study by the two botanists mentioned.  
 ver, for many years the beautiful sheets of the dried

Text-fig. 4 a.

Text-fig. 4.

b



Examples of *Chaetoceras*

forms have been a source of pleasure to the tasteful ladies  
 of the city.

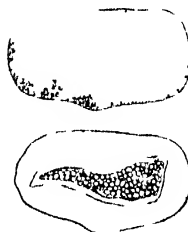
Text-fig. 4 c.

Text-fig. 4 b.



*Coscinodiscus* and other Algae

Text-fig. 4 d.



Gelatinous bodies.

The peculiar gelatinous bodies (text-fig. 4 d) which

swarmed in the Bay in May 1887† are probably algaoid, though this is uncertain. They were composed of yellow cells and simple, straight, pointed spicules, and *Oikopleura* seemed to feed on them.

*Rhizosolenia* (probably *R. setigera* and *R. obtusa*, with long frustules‡) occur in vast abundance in May and June, rendering the water obscure and blocking the fishermen's nets. The hue is olive-green and the odour on the nets is disliked by the men. In May 1888 this alga occupied the upper region, about two fathoms of the surface. The laboratory nets were coated with the same form on June 24th, 1889. At Plymouth these forms abound in July §.

The investigations of Prof. Garstang ||, Dr. Allen, Dr. Lebour, and others on the fauna of Plymouth have been of great interest in connection with the distribution and habits of the several groups, and the same may be said of Professors Herdman and Johnstone, Mr. A. Scott, and Mr. Chadwick in the Irish Sea. Indeed, many investigators have dealt with the pelagic fauna round our shores.

### Subkingdom *PROTOZOA*.

This subkingdom presents at St. Andrews a nearly unbroken field for research, for, in addition to the brief list of Foraminifera already given, the Radiolarians and the Infusoria are almost untouched.

### Class *DINOFLAGELLATA*.

#### *Ceratium tripos*, O. F. M.

In vast multitudes, along with other species of the same genus, in the warmer months (July, August, September) at the surface as well as in smaller numbers in the bottom-net. In the colder months they occurred chiefly in the bottom-nets. When the nets were jerked in the air in summer the interior became phosphorescent.

#### *Ceratium fusus*, Ehrb.

In great numbers along with the former.

† Ann. & Mag. Nat. Hist., August 1887.

‡ Journ. Mar. Biol. Assoc. 1891-1892, p. 341.

§ Bles, Journ. Mar. Biol. Assoc. vol. ii. p. 341.

|| Journ. Mar. Biol. Assoc. vol. ii. p. 333, and vol. iii. p. 210.

*Ceratium furca*, Ehrb.

Common with the foregoing.

*Ceratium divergens*, Ehrb.

Frequent in July.

*Ceratium longicorne*, Perty.

Occasionally with the foregoing. The five previous forms appear to be almost ubiquitous in British seas.

*Peridinium* sp.

Common in summer, and in smaller numbers in winter.

*Amphidinium speculatum*, Clap. & Lachmann.

Occasionally in summer.

*Tintinnus lagenula*, Clap. & Lach.

Abundant in the warmer months. Like many other forms this genus has a wide distribution in the ocean.

*Tintinnus denticulatus*, Ehrb.

Frequent with the former.

*Salpingoeca* sp.

Occurs in July.

*Vorticella* — ?

Swarms of *Vorticellæ* clothe the stems of littoral zoophytes.

Class INFUSORIA.

*Hemiophyra dalyelli*, E. W. Holt †.

On *Caligus rapax*, from the bottom tow-net.

*Zoothamnium* sp.

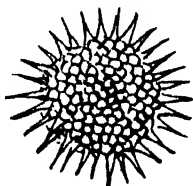
On *Lepidonotus squamatus*, L., H. C. Williamson, in January.

† Ann. & Mag. Nat. Hist. ser. 6, vol. viii. p. 182, pl. xi. fig. 1.

Class RADIOLARIA. (Text-fig. 5.)

Forms pertaining to Haeckel's *Acanthometra* are not uncommon in the warmer months, in-shore as well as

Text-fig. 5.



J. P. S.

Radiolarian ?

off-shore. The absence of *Noctiluca* and its presence at Plymouth is a noteworthy feature of distinction.

Subkingdom PORIFERA.

The Porifera of Plymouth are eighteen in number: twelve have been found at St. Andrews and six are common to both. Southern forms are *Leucosolenia complicata*, Montagu, *L. variabilis*, Haeckel, *Clathrina lacunosa*, Johnston, *Halisarca*, *Leptolabis*, *Hymeniacidum sanguineum*, Grant, *Fragosia*, *Polymastra*, and *Tethya*. At St. Andrews characteristic forms are *Leuconia nivea*, Grant, *Hymeniacidum ficus*, Esper, *H. m'intoshi*, Bowerbank, *H. incrustans*, Esper, and *Chalina limbata*, Bowerbank.

*Suberites domuncula*, Olivi.

Occasionally off the Bell Rock.

\* *Halichondria panicea*, Pallas.

The masses of this species, which are tossed by storms on the West Sands, appear to come from the Estuary of the Tay, where the dredge and trawl are often filled with them. Many of the masses are attached to the stems of tangles.

\* An asterisk prefixed to a species-name indicates that additional note is made on a form already noted in 1874.



Subkingdom *CŒLENTERA*.

In comparing the Anthomedusæ and Leptomedusæ of St. Andrews with those of the western area, as at Cumbræ, it is found that many species are common to both regions, such as *Hybocodon*, *Sarsia*, *Bougainvillea*, and *Obelia*, whilst *Corymorpha*, *Rathkea*, and *Nemopsis* are more characteristic of the west. The number of the species, however, found at St. Andrews greatly exceeds that recorded for the west, probably because Mr. Crawford and others have worked there longer at the group.

In contrasting the hydroid stages of the Anthomedusæ of Plymouth and St. Andrews many are common to both localities, but *Merona*, *Tubiclava*, *Podocoryne*, *Lar*, *Zanclæa*, *Stauridium*, *Myriothele*, *Perigonimus*, *Garveia*, and others have not hitherto been found at St. Andrews. In the Leptomedusæ the majority are common to both places. Yet *Agasira*, *Trichydra*, *Haloikema*, *Eutima*, *Octorchis*, *Irene*, and the Trachymedusæ *Lirianthe* and *Solmaris* are absent from the northern area, where *Aglantha* and *Tima* are conspicuous.

Both regions have many forms in common with the Mediterranean, for the distribution of marine animals is often wide; but *Bathycodon* and *Pandæa* amongst the Anthomedusæ, *Eucopium* amongst the Leptomedusæ, *Olindias* (Trachylinæ), many Narcomedusæ, *Abyla*, *Rhizophysa*, and *Forskalia* amongst the Siphonophora are more or less distinctive of the Mediterranean. In the same way *Callianira* and *Cestus* amongst the Ctenophores are confined to the southern sea.

## Class ANTHOMEDUSÆ † (ANTHOZOA).

\**Tubularia indivisa*, L.

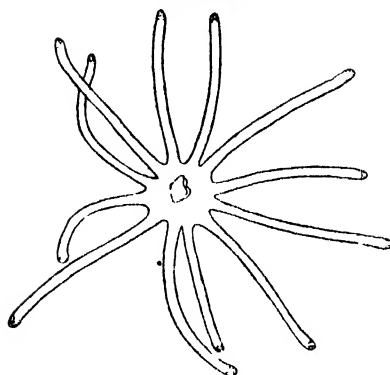
The actinula stage (text-fig. 6) occurs in swarms amongst pelagic young *Peachia* and *Hybocodon* from May to August. The pale actinula often attaches itself by the bulbous end to sand-grains. The examples figured have not yet developed the oral tentacles. *Arachnactis*-larvæ are often abundant in the bottom-nets in May.

*Syncoryne eximia*, Allman.

Gonozoids in May.

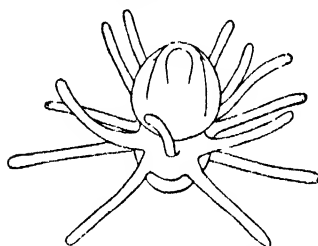
† I am much indebted to Mr. Ed. T. Browne for revising the nomenclature of the Medusæ, and for valued criticism.

Text-fig. 6.



Actinula-stage of *Tubularia*.

Text-fig. 6a.



Actinula-stage of *Tubularia*.

*Podocoryne carnea*, Sars.

Gonozoids in May.

*Stauridium productum*, S. Wright.

Gonozoids in June and July.

Though the month of capture is stated such does not necessarily imply that the form is not present before and after the period (*vide* 8th Rep. Scot. Fishery Bd. part iii. p. 270).

*Sarsia tubulosa*, Sars.

Abundant in summer.

*Sarsia gemmifera*, Forbes.

August ; rare.

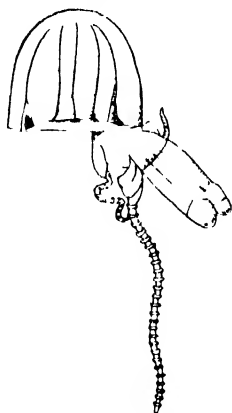
*Sarsia pulchella*, Forbes.

Midwater-net in May.

*Hybocodon prolifer*, Agassiz. (Text-fig. 7.)

Chiefly in May. They greedily engulf young cuttlefishes.

Text-fig. 7.



*Hybocodon prolifer*, Agassiz.

On the west coast they frequently occur in June. Numerous examples on 6th May, 1889 †.

*Corymorpha nutans*, Sars.

Fine examples (3 inches) procured opposite Kingsbarns in 1884, with a copper rope to the dredge on board the 'Medusa,' kindly lent by Sir John Murray. It has not been seen since.

*Euphysa aurata*, Forbes.

Common in August.

*Nesturris pileata*, Forskål, including *N. digitalis*, Forbes.

Common in August. Male organs fully developed in December.

*Bougainvillia flavida*, Hartlaub.

Common in August. This species, *Sarsia*, and *Phialidium*

† Sheila Marshall, Proc. R. S. E. vol. xlv. p. 126.

were placed under running water in a vessel which was subsequently covered with a growth of *Syncoryne dicipiens* †.

*Bouganvillia nigritella*, Forbes.

June to September.

*Rathkea blumenbachii*, Rathke (= *Rathkea octopunctata*, Forbes).

Midwater-net in March–August. Numerous buds in March.

*Lizzia blondina*, Forbes.

Near the Bell Rock in August. At Plymouth it appears in summer and disappears in September (Garstang and Browne).

*Willia stellata*, Forbes.

Medusa of *Lar sabellarum*, Gosse, on tubes of *Sabella*. It is found at Plymouth in September (Browne).

*Leuckartia octona*, Fleming.

Bottom-net in March; ripe in August; large and small examples in September and variety in June.

*Oceania globulosa*, Forbes (? *Turritopsis polycincta*, Keferstein).

Midwater-net in August and September.

*Oceania* — ?

A form in August with only one yellow tubercle between the tentacles; pinkish ocelli and ovaries. Resembled *O. octona*.

*Podocoryne carnea*, Sars.

Gonozoids in July.

*Stauridium productum*, S. Wright.

June and July.

*Melicertum octocostatum*, Sars.

August.

† Ann. & Mag. Nat. Hist., Aug. 1887, p. 99.

Class LEPTOMEDUSÆ †.

*Phialidium hemisphæricum*, Gronovius.

June to August. This is a favourite "carriage" for young *Peachia* and others. It includes *Obelia lucifera*, Forbes.

*Phialidium quadratum*, Forbes = *Eucope globosa*, Forbes.

July to August.

*Cosmetira pilosella*, Forbes = *Thaumantias pilosella*, Forbes.

Abundant, July to August.

*Phialidium* — ?

A comparatively large form ( $1\frac{3}{4}$  inches in diameter), met with at the beginning and end of June, and often in great numbers in July with the male elements well developed, but none with ripe ovaries. It differs from *C. pilosella* in the arrangement of the tentacles and in the length of the manubrium.

*Phialidium octona*, Forbes = *Phialidium inconspicua*, Forbes.

In the midwater-net in June, and in the surface-net in August.

*Phialidium maculata*, Forbes = *Eucope globosa*, Forbes.

May to August. In multitudes in the midwater-net in June.

*Thaumantias gibbosa*, Forbes.

June. Mr. E. T. Browne observes that Forbes found it off the Hebrides, and it has not since been traced. It is not a *Thaumantias*.

*Thaumantias pileata*, Forbes.

June.

*Phialidium hemisphæricum* (Gronovius), O. F. M.

June to December.

† For the identification of some of the Anthomedusæ and Leptomedusæ I am indebted to the late Rev. J. Crawford (*vide* Ann. & Mag. Nat. Hist., Sept. 1891, p. 295).

*Obelia lucifera* = *Phialidium hemisphæricum*, Forbes.

March to June. Vast numbers of specimens of *Phialidium* were beached on the West Sands on 31st May, 1887, and they also swarmed in the Bay.

*Tima bairdi*, Forbes.

December to February. A form closely resembling *Tima bairdi*, though smaller, was in the same condition as *Staurophora*, no manubrium being present †. It probably belongs to a genus allied to that just mentioned.

*Tiaropsis* sp.

On the 28th October, 1897, a somewhat conical Medusa (like an inverted Lucernarian) was obtained in the bottom-net with eight marginal sense-organs and an open fold of the velum. The sense-organs were pale red and the manubrium was short. The shape (inverted cone) perhaps indicates that the example is young.

\**Clytia johnstoni*, Alder.

Gonozoids on April 26th, 1887. The polyps had thrown off the old thecæ and new ones were growing, the stem at the same time being elongated.

*Aglantha (Circe) rosea*, Forbes.

December and January to April; with eight long pale ovaries. This form usually becomes prominent about the end of October.

*Staurophora mertensii*, Brandt = *Thaumantias melanops*, Forbes.

Midwater-net, August 1886. This was at first described as an abnormal form ‡, but its true position is amongst the Leptomedusæ and described by A. G. Mayer § as having a cruciform gutter-like mouth extending down the radial canals, which are open grooves bordered on their edges by curtain-like walls containing the gonads. It is a comparatively large species, 100 to 200 mm. in diameter and 30 to 50 mm. high, with thick gelatinous substance. The aboral side is smoothly rounded. The species was first described by Brandt from the Aleutian Islands, and apparently is identical (Mayer) with *S. laciniata*, L. Agassiz, from the

† Ann. & Mag. Nat. Hist., January 1890, p. 41.

‡ Tom. cit. p. 40, pl. viii. fig. 1.

§ 'Medusæ of the World,' vol. ii. p. 291, pl. xvi. figs. 4-9, vol. i.

North Atlantic. In its younger or "*Staurostoma*" stage it has been made a separate species in which the mouth extends only part of the way along the radial canals. Its range, like that of many pelagic forms, extends to both sides of the Atlantic and into the North Sea, as well as to the seas of Greenland. On the American shores it appears in early spring and disappears in October, and the British species would appear to agree in this respect.

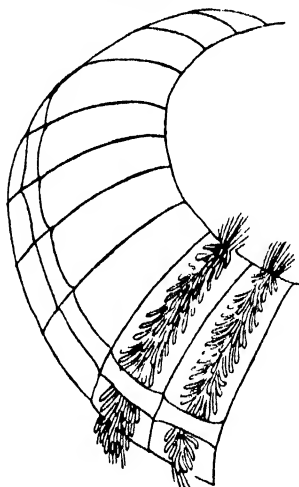
*Æquorea forbesiana*, Gosse.

In the midwater-net in the Bay, July 1886.

*Æquorea* — ? (Text-fig. 7 a.)

The complex and somewhat dendritic alimentary system shown in the fragmentary sketch is diagnostic.

Text-fig. 7 a.



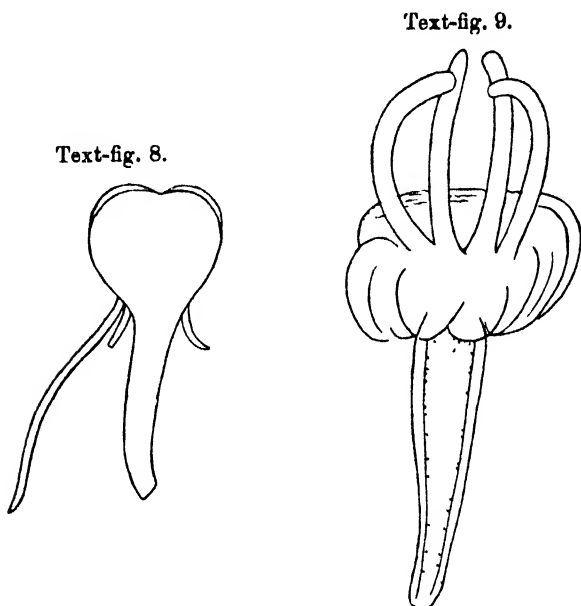
*Æquorea* — ?

It is curious that no example of *Saphenia mirabilis*, Strethill-Wright, has been seen in the Bay, though originally found in the Forth.

\**Lafoea dumosa*, Fleming.

On *Sertularia abietina*.

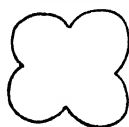
A curious condition was met with in certain *Anthomedusæ* (*Sarsia*) on the 20th of November, 1890, in which the discs were turned inside out (text-figs. 8 & 9), the manubrium forming a long process inferiorly, whilst four tentacles



Everted examples of *Sarsia*.

projected above the translucent frilled mass of the disc, and their surface was slightly rough, as if from thread-cells. The interior of the projecting manubrium was granular, as

Text-fig. 10.



Minute Cœlenterate.

also was the outer more translucent layer, and these parts were pinkish.

It is at present difficult to say what the quadrilobate minute medusoid form (text-fig. 10) is, though probably an



early stage of a known type. It was found in the bottom-net on 6th March, 1891. It moved slowly in the water, but is apparently unconnected with the larval forms of *Actinæ* or with the Nemertean *Pilidium*.

*\*Obelia geniculata*, L.

Examples of a deep brownish colour covered the crustacean parasites on the gills of a tunny.

Bles† had to add acid to the water to produce phosphorescence in *Obelia lucifera*, whereas in 1871 mere shaking of the vessel caused the medusoids of the common form to scintillate.

*\*Gonothyræa loveni*, Allman.

The habit of this species in the estuary of the Eden is interesting. It grows luxuriantly on the mussels in the bed of the river, dies down annually, springing up again the following season. As the stems and branches are quickly laden with young mussels, this annual rupture of the zoophyte tends to spread somewhat older mussels on the beds in the vicinity, whilst the pelagic younger forms are carried out to sea.

*\*Sertularia pumila*, L.

Besides the sites mentioned, it often hangs from the roofs of caverns and ledges near low-water mark. The hydrothecæ lodge the ova of *Pycnogonon*.

*Diphasia* var.

Occasionally from deep water.

*Polyxenia cyanostylus* (= *P. alderi*, Forbes).

? August.

Further details of the foregoing Medusæ are given in the Ann. & Mag. Nat. Hist. for April 1890.

Suborder **MEDUSÆ** (DISCOMEDUSÆ).

*\*Aurelia aurita*, Lamarck.

The vast numbers of this species in the Bay in July thicken the surface-water, fill the nets, and are thrown in

† Journ. Mar. Biol. Assoc. ii. p. 341 (1892).

masses on the beach. Moreover, in February, March, and April the ephyrae are pumped in numbers with the sea-water into the tanks of the Laboratory. Some turn themselves inside out, the gastric filaments projecting as four groups of filaments like tentacles.

On May 25th young *Aurelia* were  $1\frac{1}{2}$  inches in diameter. The effect of swarms of *Aurelia* on the pelagic fauna may be estimated by a reference to its food, as shown by Dr. Lebour † and others. It will devour twenty newly hatched *Cotti* in half an hour; and so with *Phialidium hemisphericum* and others in a less degree. *Arachnactis* has the same habit.

\**Cyanea capillata*, Eschsch.

A large example 23 inches in diameter occurred on the West Sands, October 8, 1884. Whilst for the most part absent from the coastal water in winter, large examples are occasionally met with in deep water south off the Isle of Man. Both males and females occur in August. It was formerly shown ‡ that *Cyanea lamarcki*, Peron and Lesueur, was only the young stage of *C. capillata*. Young forms on 25th May are  $1\frac{1}{2}$  inches in diameter. At Plymouth the presence of *Rhizostoma* is distinctive.

On 16th July, 1910, thousands of *Aurelia aurita* lay on the East Sands, and a fragment of a single *Cyanea* of a brownish colour and about 14 inches in diameter amongst them; also a few young *Cyaneae* of a rich blue tint were scattered here and there.

## Order SIPHONOPHORA.

### Suborder PHYSONECTÆ.

#### Genus HALISTEMMA §.

Met with occasionally in May and June, N.E. of pier.

It would appear that the *Muggiea atlantica*, as described by T. Cunningham || from Plymouth, is the same form as that not uncommon in Lochmaddy in 1865 (*Diphyes*), and mentioned in the "Fauna" ¶. The figures given by

† Journ. Mar. Biol. Assoc., Oct. 1922, p. 651.

‡ Ann. & Mag. Nat. Hist., February 1885.

§ Rev. Dr. Sloan, Ann. & Mag. Nat. Hist., May 1891, and E. W. Holt, id. p. 184.

|| Journ. Mar. Biol. Assoc. ii. p. 212, figs. 1 & 2; and further notes, ibid. pp. 342 & 398.

¶ Proc. Roy. Soc. Edinb. 1865-66.

Mr. Cunningham are identical. The same form had previously been observed by Mr. Peach at Fowey. It appears to have a wide distribution. The fine orange colour of the zooids is not alluded to in these notes. This form appeared at Plymouth in August and remained till December in 1895 (Garstang, Journ. Mar. Biol. Assoc. ii. p. 334).

### Suborder STAUROMEDUSÆ.

\**Halichlystus auricula*, O. Fabr. (or *octoradiatus*).

Was abundant on the *Fuci* at the rocks called "Burn Stools" till the groin at the harbour was built. This caused the sand to overwhelm these rocks, and the Lucernarian disappeared, as also did many Nudibranchs which had bred there every season. At Plymouth Prof. Garstang found this species attached to *Ceramium* and *Enteromorpha* (Garstang).

*Lucernaria campanulata*, Lamouroux, and *Depastrum cyathiforme*, M. Sars, of Plymouth waters, are absent.

### Class ACTINOZOA.

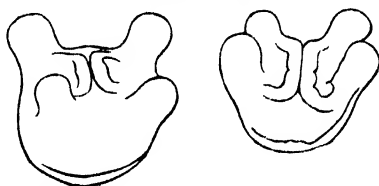
\**Peachia cylindrica*, John Reid = *P. hastata*, Gosse.

In summer (July and August) the young (post-larval) of this form attach themselves to the discs of *Thaumantias* and are carried about in the water without effort of their own.

Text-fig. 11.



Text-fig. 11 a.



Young *Actiniae*.

When large examples turn themselves inside out they have been mistaken for Holothurians. The Medusæ bearing the young of *Peachia* are often near the bottom of the water in June. Numbers of adult *Peachias* were cast on the West Sands after a storm in November. The *Actinia cylindrica* of Prof. John Reid † appears to be this species. He found it on the West Sands, St. Andrews. Prof. Garstang states that at Plymouth the Leptomedusæ which carry the young

† Physiol. & Anat. Researches, 1848, p. 656, pl. v. figs. 21 & 22.

stages of *Halcampa crysanthellum* are in part the young stages of *Irene pellucida* and *Phialidium*.

Young *Actiniæ* float like *Arachnactis* with the tentacles extended (text-figs. 11 & 11 a); they are translucent, dull yellowish, only the tips of the tentacles being opaque.

The young stages of *Peachia*, *Edwardsia*, and ? *Cerianthus* are not uncommon in the tow-nets, and sometimes in considerable numbers (text-figs. 11 & 11 a).

A young specimen examined does not correspond to the description of the adult, but it may be that the early pinkish hue subsequently breaks up.

### Class ALCYONARIA.

#### \**Pennatula phosphorea*, L.

This is now seldom seen in the harbour since the fishermen have altered their methods. Formerly it was procured in hundreds about 9 miles S.E. of the Carr Rock—on Brownsides ground off Dunbar. It is not entered in the Plymouth lists.

#### \**Alcyonium digitatum*, L.

A specimen captured on the tube of *Sabella penicillus* shed its ova on the 17th November, 1897. They were of a fine coral-pink, with a diameter of .4572. Whilst some lie on the bottom of the vessel, others float on the surface.

#### *Bunodes ballii*, Cocks.

Occasionally in the deeper water south of the Bell Rock.

#### *Hormathia margaritæ*, Gosse.

In the deeper water south of the Island of May, attached to living examples of *Fusus antiquus*. Gosse had only a single example from the Moray Firth.

#### *Bolocera tuediæ*.

South of the Isle of May.

It is difficult to make a comparison of the Cœlenterates with those of Plymouth from the nomenclature adopted, but *Cerianthus*, *Metridium*, *Edwardsia*, *Sagartia*, and *Bunodes* are common to both areas, whereas *Epizoanthus*, *Halcampa*, *Corynactis*, *Caryophyllia*, and others are absent from the north,

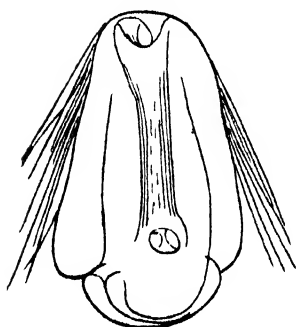
whilst *Peachia* abounds at St. Andrews and *Hormathia* is not uncommon to the south of the Bay. Again, such a form as *Eloactis mazeli*, Jourd., found by Prof. Garstang at Plymouth, is diagnostic. Many of the group range to the Mediterranean, the Anthozoa of which, however, exceed in variety those of the British waters—*Haimea* and *Clavularia* being characteristic. The Zoantharia Malacodermata likewise excel in species, as also the Antipatharia and Madreporaria.

### Class CTENOPHORA.

#### \**Pleurobrachia pileus*, Eschsch.

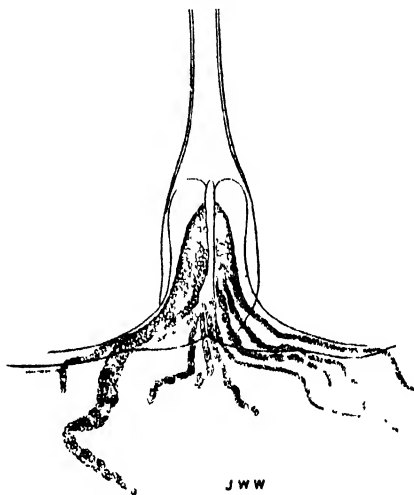
Pear-shaped embryos occurred in the free ova on 2nd July, circling within the capsule by aid of cilia. The Bay is seldom without this species, and in August enormous numbers of all sizes are occasionally met with. In 1891, however, an

Text-fig. 12.



Young Ctenophore.

Text-fig. 13.

Filaments of lobe of *Lesueuria*.

almost complete absence of this form occurred during the spring and summer—a disappointment to Mr. Riches, who had come to study its development. This form takes the place of *Hormiphora plumosa* (should that differ) at Plymouth, where the Ctenophores are rare in winter,

*Lesueuria vitrea*, M.-Edw. (? *Bolina infundibulum*, Fabr.).

Appears in great numbers from May to July, and smaller numbers in winter. It is phosphorescent and engulfs *Pleurobrachia*. Young forms common 14th January, 1892. The filaments of one of the principal lobes are shown in text-fig. 13.

*Bolina norvegica*, Sars, or *ovata*, Eschsch.

The phosphorescent *Beroë* is disliked by the fishermen, as it shows the net.

In the bottom-net on 14th February a young Ctenophore (text-fig. 12) with enormous cilia was obtained, whilst at the calm surface were small examples of *Beroë* and *Lesueuria*, with swarms of *Parathemisto* darting about, and small *Sagittæ*. In November, again, many small examples of *Pleurobrachia*  $\frac{1}{16}$  and  $\frac{1}{10}$  of an inch occurred, whilst on the 14th of January, 1892, numerous young of *Beroë* and *Lesueuria* were captured in the bottom-net and a few adults of each form in the midwater-net.

The Ctenophores appear to be less common at Plymouth than at St. Andrews. Thus Hodgson † points out that no trace of these occur in winter, whereas they are abundant at St. Andrews.

### Subkingdom *ECHINODERMATA*.

Thirty-six species of Echinoderms ‡ occur at Plymouth, and of these nineteen occur at St. Andrews. Strictly southern forms include *Antedon*, *Porania*, *Palmipes*, *Asterias glacialis*, certain species of *Cucumaria* and *Echinocardium*. *Asterias mulleri*, *Hippasterias phrygiانا*, *Luidia*, *Echinus flemingii*, and *Psolus phantapus*, L., again, are characteristic of St. Andrews. Most of the genera range to the Mediterranean, yet the latter area is distinguished by such as *Chætaster*, *Astrella*, *Pectinura*, *Diadema*, the *Metalia*, and the *Molpadidæ*.

Occasionally at the East Rocks large specimens of *Echinus esculentus* are found adhering to the rocks and seaweeds considerably above low-water mark, as in Cornwall (Trewavas).

† Journ. Mar. Biol. Assoc. 1895, vii. p. 174.

‡ A note on the pelagic larval Echinoderms appears in the 8th Ann. Rep. Fishery Board for Scotland, part iii. p. 277.

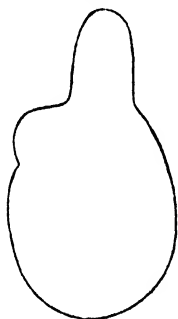
\**Ophiothrix fragilis*, O. F. Müller.

On July 10th masses of brownish-red ova occurred between the bases of the arms. This species is not met with in the masses found, for instance, in the Irish Sea off Peel.

\**Echinaster oculatus*, M. & Tr. (*Cribrella oculata* †).

The ovaries form branched organs, one on each side of the base of the ray, in November. The embryos develop slowly. In a female bearing ova procured in February the embryos show only an anterior process, and two basal swellings on 20th March (text-fig. 14). A lateral view (text-fig. 14 a).

Text-fig. 14.



Text-fig. 14 a.

Embryos of *E. oculatus*.

shows that each is flattened, and this probably explains its position. Many larvæ occur in the tow-nets in May.

What appears to be a Bipinnarian larva—probably of *Luidia*,—procured at St. Andrews in August and September, is given in text-fig. 15. The preoral and longitudinal ciliated bands are indicated by the lines at *pb* and *lb*, the mouth at *m*, and the vent at *a*.

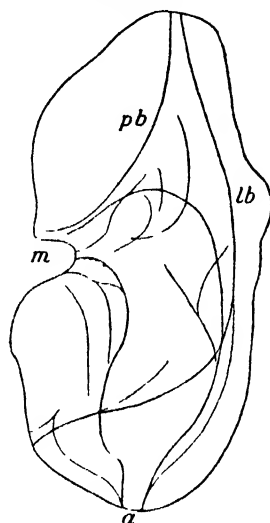
Larval starfishes (*Cribrella*?) of a bright orange colour and pelagic occurred in May 1900. The median process was long, the lateral short.

The remarkable *Bipinnaria asterigera*, the larval form of *Luidia*, constitutes one of the features of the pelagic fauna in autumn.

† *Vide* Dr. Masterman's researches, Trans. Roy. Soc. Edinb. 1901-2, part ii. p. 373, 5 pls.

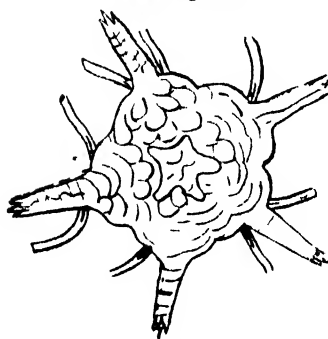
Originally described by Sars †, this curious Bipinnarian was subsequently examined by Koren and Danielssen ‡, who

Text-fig. 15.



Bipinnarian larva.

Text-fig. 16 a.



Young Ophiuroid.

showed the starfish in connection with the Bipinnaria. J. Müller §, again, gave a further account of the same form.

† Beskriv. og Jagt. &c., Bergen, 1835.

‡ Ann. Sc. Nat. 3 sér. t. vii. p. 347, pl. vii. figs. 7-9.

§ Abhandl. d. k. Akad. Wiss. Berlin, 1850, p. 81, pl. xv.



Prof. Garstang † found a similar type at Plymouth, which he carefully described and figured, though the starfish was not yet developed. In the specimen from St. Andrews the starfish (*Luidia*) was present. The great size of one of the preoral arms and the absence of symmetry of the region are conspicuous features in the St. Andrews example, as, indeed, is the entire region in front of the starfish.

The example from St. Andrews agrees more with the figure of Sars than with more recent outlines, the great development of the preoral region being conspicuous, the flattened main lobe being slightly bifid, and the flag-like secondary lobe being situated a considerable distance downward. The early starfish is clearly seen in the figure (40 *b*) of Sars, and is repeated in fig. 40 *d*. Prof. Garstang's specimen from Plymouth probably belongs to a different species from that at St. Andrews.

Many young Ophiuroids (text-fig. 16 *a*) occur in the bottom tow-nets, especially if they happen to touch the ground, towards the end of the year.

*Luidia ciliaris*, Gray = *Luidia savignii*, M. & Tr.

Off St. Andrews Bay and near the Island of May. Ovaries dichotomously divided, well developed on July 10th. Ova elongate-ovoid, with nucleus, nucleolus, and a delicate capsule. The ripe ova seem to be pelagic.

\**Solaster papposus*, L.

This devours other starfishes.

\**Asterias rubens*, L.

Ova are small in the dendritic organs in November. When sailing over the Bay in quiet clear water the floor for square miles is carpeted by this species, which is destructive to fishes on the lines, rendering them unsightly in the market. In November the lines in fishermen's baskets from the north bank near Tents Moor were covered with hundreds of small forms about an inch across and apparently of similar age. Such were probably more than a year old, since the spawning-period is in June and July. In one the male organs were fairly developed in March, sperm escaping in the vessel on 22nd March in mild weather.



† Quart. Journ. Micr. Sci. vol. xxxv. p. 451, pl. xxxv.

Swarms of the Bipinnarians and Brachiolarians occur in July and August.

*Asterias mulleri*, Sars.

Not uncommon between tide-marks near the Maiden Rock in pools near high-water mark. It is this form which is mentioned on p. 94 (*Marine Invert. and Fishes, St. Andrews*) as occupying a stool-like position in November over its eggs, which more or less close its mouth †, as also do the larvæ with three arms. The ova are nearly ovoid in outline, with a very thin chitinous investment, and the ambulacra of the adult are frequently attached to them and again drawn off with a jerk.

*Hippasterias phrygianna*, Parelius.

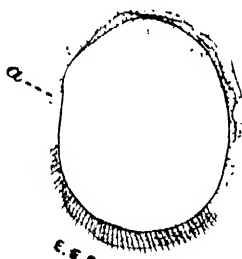
North-east region of the Bay.

Class HOLOTHUROIDEA.

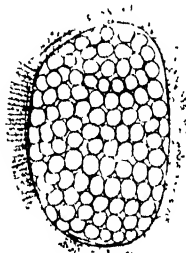
\**Cucumaria frondosa*?

An example on the 20th April, 1885, discharged—Prof. Prince thought from the tentacular region—a quantity of reddish or deep orange ova (text-fig. 16 *b*), which floated on

Text-fig. 16 *b*.



Text-fig. 16 *c*.



Ova of *Cucumaria*.

the surface; others passed strings of ova which broke on lifting. The ova were ovate or rounded, and presented a "woolly" aspect from a striated protoplasmic investment, and this prevented the escape of the yolk-granules when the

† See Masterman, *Trans. Roy. Soc. Edin.* vol. xxi. p. 59.

ova were ruptured. The early larvæ move slowly in the water by aid of cilia. On the 21st April the entire egg within the capsule was filled with small spheres, as shown in text-fig. 16 c.

### Subkingdom *VERMES*.

#### Order *CHÆTOGNATHA*.

##### \**Sagitta bipunctata*, Quoy & Gaimard †.

Vast swarms of middle-sized and small ( $\frac{1}{4}$  inch) *Sagittæ* occurred in the nets on the 18th April, 1891, and generally they are present throughout the year.

This is eaten by many pelagic forms, such as *Pleurobranchia*, *Obelia*, and *Phialidium* (Lebour). It is a common food of the Hydromedusæ. On the other hand, it is fond of Copepods, newly hatched herrings, and its own species.

#### Family *Orthonectidæ*.

##### *Intoshia linei*, Giard.

Abundant in the hypodermic tissues of *Lineus gesserensis* †, where it was first found.

[To be continued.]

XXXIII.—*Some Mammalia from the Pliocene of Homa Mountain, Victoria Nyanza*. By ARTHUR T. HOPWOOD, M.Sc., F.L.S.

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IN 1911 Dr. Felix Oswald undertook a journey to the north-eastern coast of the Victoria Nyanza for the purpose of collecting mammalian remains from the Lower Miocene Beds in the neighbourhood of Karungu. This being done he made an extensive traverse across the plains to the foot of the Kisii Highlands, going thence to Homa and on to

† *Spadella bipunctata*, Hodg. Journ. Mar. Biol. Assoc. 1895, vii. p. 175.

‡ Trans. Roy. Soc. Edinb. vol. xxv. p. 386, pl. xii. fig. 4.

**Kendu.** On the journey from Homa to Kendu he took the opportunity of collecting fossils from the Pliocene deposits which lie to the north and east of Homa Mountain. It is these fossils which are dealt with in the present note. The Miocene Beds and their contents have been described in detail by F. Oswald, C. W. Andrews, and R. Bullen Newton (1914, Quart. Journ. Geol. Soc. lxx. pp. 128–198, pls. xx.–xxx.).

The fossils indicate that the fauna is typically African. They comprise Hippopotamus, Pigs, Oxen, and Elephant, and the remains, though scanty, are not without interest, as they enlarge our knowledge of the Mammalia in the neighbourhood of the Great Rift Valley at the close of Tertiary times.

## Order ARTIODACTYLA.

### Suborder SUINA.

#### Family Hippopotamidæ.

#### Genus HIPPOPOTAMUS, Linnæus.

#### *Hippopotamus amphibius*, Linnæus.

**Material.**—A second right upper molar, regd. M 12801 B.M. Geol. Dept.; the tip of a ? left lower canine, registered M 12799, B.M. Geol. Dept.; a few carpal and tarsal bones with three metapodials, registered M 12800, B.M. Geol. Dept.

**Remarks.**—Each of these is typically Pliocene in the condition of the various anatomical land-marks. Thus the molar has all the features of *Hippopotamus amphibius*, but in a modified degree. The anterior and posterior cingula are not so strongly developed, and, possibly, the trefoil pattern is more marked. Similar conditions obtain among the bones. The articular facets are, relatively, not so large nor are they so sharply defined as in the recent form.

To sum up, the remains are in the same state of evolution as the bones and teeth of *Hippopotamus* from the Pliocene deposits of Europe, from which they differ only in being somewhat smaller, and not to such an extent as to warrant the establishment of a new variety.

#### Family Suidæ.

#### Genus METRIDIOCHÆRUS, gen. nov.

**Diagnosis.**—Pigs with rooted, hypsodont, third molars.

Enamel-pattern complicated, intermediate between *Hylodochærus* and *Phacochærus*, the degree of folding being such that very little more would be necessary to cause the figures to split up into separate pillars. Talon, and probably the whole tooth, with an enamel-pattern of numerous small rings in the early stages of wear.

*Genotype*.—*Metridiochærus andrewsi*, sp. n.

*Material*.—A third upper molar; holotype registered M 12805, B.M. Geol. Dept. Two talons of third molars (both upper teeth?), paratypes registered M 12805 *a* & *b*, B.M. Geol. Dept.

*Dimensions*.—

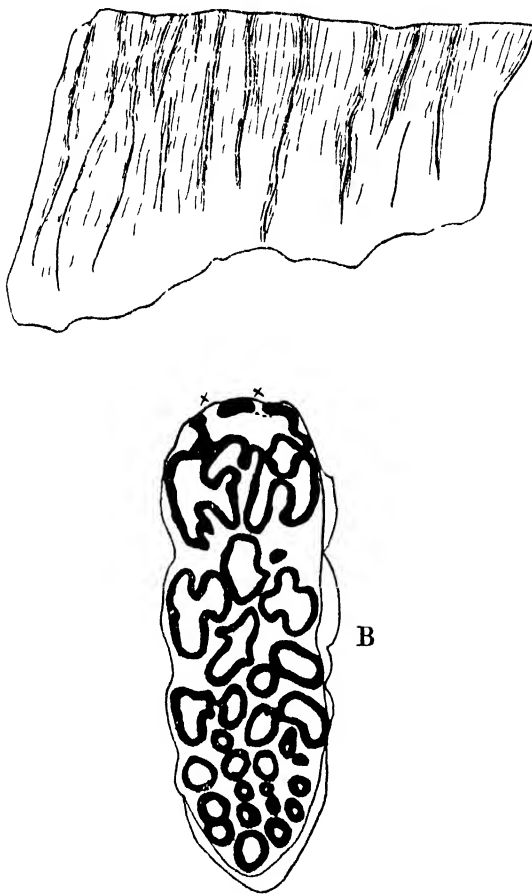
	mm.
Extreme length .....	66
Width .....	21
Length of grinding-surface .....	57
Extreme height at talon (unworn) ....	40

*Description*—The anterior cingulum appears to be large and well developed, a point which is rendered somewhat obscure by a certain amount of cracking of the specimen. It is remarkable for being curved forward as it proceeds from the root to the grinding-surface, so that the grinding-surface itself projects beyond the roots for a distance of about 5 mm. The four main cusps are arranged in pairs with an accessory cusp between them, giving rise to a quincunx. Their enamel is strongly folded, so that the pattern revealed when in wear is easily susceptible of being broken up into a number of small rings.

The grinding-surface shows the enamel as a number of large and small rings. The more anterior of these are the larger and have a tendency to be more or less folded; the posterior ones are practically circular. On examining the lateral surface the reason for this at once becomes clear. The rings are seen to be the cross-sections of finger-like processes. These processes gradually unite as they approach the base of the tooth, and are finally indicated by grooves in the enamel of larger units. Since the grinding-surface is not parallel to the base of the tooth the processes are cut in different planes, and, since the anterior ones have been worn to a greater extent than the posterior ones, it follows that the anterior figures will be more complex, owing to the coalescence of several processes. References to the figures in the text will make this clear.

*Remarks*.—The phenomenon described in the preceding paragraph is of considerable importance when considering the

teeth of *Phacochaerus*. It is well known that these are built up of numerous columns and that, in most cases, they are of persistent growth. My colleague, Mr. M. A. C. Hinton,



*Metridiochaerus andrewsi*, gen. et sp. n.

- A. Holotype seen from the lingual surface; B. The same seen from the grinding-surface. Both views natural size. Registered M 12805, B.M. Geol. Dept.

has been able to show that, provided the animal lives long enough, the columns finally coalesce and the teeth form roots. The fossil shows us a stage in the evolution of the

columns. Here we are enabled to see them being formed by the splitting of larger elements through excessive folding of the enamel of the latter. As time went on the columns became longer and longer until they reached the base of the tooth. The mode of feeding adopted by the animal proved expensive of tooth-substance, and the roots formed at an ever later period of the life of the individual, until, at present, they form so late as to be unknown except in very few cases.

This is not meant to imply that *Metridiochærus* is ancestral to *Phacochærus*; the most that can be said is that it represents a possible stage in the evolution of the genus, and that for the first time we have apparent confirmation of the theory put forward to account for the structure of the teeth in the modern animal.

The generic name is derived from the Greek *μητριδιος*, fruitful, and *χοιρος*, pig. The species is named in honour of the late Dr. C. W. Andrews, F.R.S., who intended to work out the collection, and who, had he done so, would have been quick to appreciate the significance of the teeth under consideration.

*Phacochærus æthiopicus*, Linnæus.

*Material*.—One third lower molar; registered M 12804, B.M. Geol. Dept.

*Remarks*.—This is a typical wart-hog molar. There are said to be two species of this animal in Africa, but, since Mr. Hinton has come to the conclusion, as a result of his study of the genus, that they are only varying forms of one and the same thing, the present specimen is distinguished by the original Linnæan name.

A portion of the lower canine may also belong to this species.

Family **Bovidæ**.

Genus *Bos*, Linnæus.

An indeterminate species of *Bos* is represented by two upper molars (M 12803, B.M. Geol. Dept.). They are of comparatively small size, are more compactly built than is usual, and indicate a smaller animal than the one found at Kaiso, Uganda, in deposits of about the same age. It is hoped that further collections from Central Africa may throw light on what promises to be an interesting form.

## Order PROBOSCIDEA.

## Genus ELEPHAS, Linnæus.

*Elephas antiquus*, Falconer, var. *recki*, Dietrich.

**Material.**—Portions of the third upper molar of either side; the right and left mandibular rami (incomplete) with *M* 3; fragments of much-worn teeth from both the upper and lower jaws. Six specimens registered M 11977–11979, B.M. Geol. Dept.

**Remarks.**—The teeth of *Elephas antiquus* belong undoubtedly to the form described by W. O. Dietrich as *E. antiquus recki* (1916, Arch. f. Biontologie, Bd. iv. Heft 1, pp. 1–80, pls. i.–viii.). The present material does not add anything to our knowledge of the anatomy of the animal, but it represents a somewhat smaller form. It may be well that there is more than one race of the variety *recki*. The type-material was obtained from Oldoway, to the east of Mwanza, on the south of the Victoria Nyanza, some 200 miles in a straight line to the south-east of Homa Mountain.

*Table of Measurements of Teeth from Homa Mountain.*

Tooth .....	<i>M</i> 3	<i>M</i> 3	<i>M</i> 3	<i>M</i> 3
Registered number .....	M 11977 <i>a</i>	M 11977 <i>b</i>	M 11978 <i>a</i>	M 11978 <i>b</i>
Number of plates .....	$\times^3 11 \times$	$\times^4 11 \times$	$\times 15 \times$	$\times 15 \times$
Length (millimetres) ....	202	206	295	298
Breadth „ .....	77	75 (v.)	73 (v.)	78
Height „ .....	113	126 (x.)	127 (ix.)	?
Lamellar index .....	5.4	5.3	5	5.4
Length-lamella quotient .	18.4	18.7	20	18.6
Length-breadth quotient .	?	?	4	3.8
Enamel thickness .....	2.5–3	2.5–3	3–3.5	3–3.5
Digitations .....	1–3–1	1–3–1	1–3–1	1–3–1
Development of figures ..	Lateral annulus, median lamella.			

## CONCLUSION.

The mammalian faunas of Eastern Tropical Africa are only imperfectly known, but, so far as they have been investigated, they show that the main lines of the modern fauna were already mapped out in late Tertiary time. They include Antelopes, Oxen, Hippopotamus, Rhinoceros, and Elephant. Carnivores are rare and, as a rule, are entirely unrepresented. The smaller mammals, such as Rodents and Insectivores, are practically unknown, though this may be



due—in part, at least—to the conditions under which the various collections were made.

The following list gives the more important localities which have been explored in part, together with the names of the chief mammals and selected items of literature. Further references will be found in the works mentioned :—

- (1) LAKE RUDOLPH. (. . . au nord du lac Rodolphe, le long du cours inférieur de l'Omo et dans la vallée de la Podi . . . )  
*Hipparion*?, *Rhinoceros*, *Hippopotamus*, *Phacochærus*,  
*Buffelus*, *Camelopardalis*, *Dinotherium*, *Elephas*.  
 Haug, 1911, *Traité de Géologie*, ii. 3, p. 1727.
- (2) VICTORIA NYANZA. (. . . beds of lower Miocene age in the neighbourhood of Karungu, near the eastern shore of the Victoria Nyanza.)  
*Dinotherium*, hyracoids, anthracotheres, *Rhinoceros*,  
*Paraphiomys*, *Pseudælorus*.  
 Andrews, C. W., 1914, *Quart. Journ. Geol. Soc.*  
 lxx. pp. 163–180, pls. xxviii.–xxix.
- (3) SERENGETI STEPPES and OLDOWAY.  
*Hipparion*, *Helladotherium*, *Rhinoceros*, *Hippopotamus*,  
 pigs, dogs, buffalo, numerous antelopes, baboon,  
 and *Elephas*. A *Mastodon* may also be present.  
 Bianca, W., 1914, *Sitzungsber. Akad. Wiss.*  
 Berlin, Jahrg. 1914, pp. 1164–1182.  
 Reck, H., 1914, *Sitzungsber. Ges. Naturf. Freunde*  
 zu Berlin, no. 7, pp. 305–318.  
 Dietrich, W. O., 1916, *Arch. f. Biontologie*, iv.  
 Heft 1, pp. 1–80, pls. i.–viii.
- (4) KAISO, ALBERT NYANZA, UGANDA.  
*Hipparion*, zebra, *Hippopotamus*, *Rhinoceros*, pigs, oxen,  
 and various antelopes. A giant feline may be  
 present.
- (5) LAKE NYASSA.

Satisfactory mammalian remains are as yet unknown from this district. Up to the present *Hippopotamus* and fragmentary proboscidean teeth have been found.

It will be noticed that only the larger mammals are known so far, and reference to the works quoted will go to prove that there is yet much work to be done before our work can be said to rest on a satisfactory basis.

XXXIV.—*Papers on Oriental Carabidæ*.—XVIII.

By H. E. ANDREWES.

A good deal of material has been sent to me during recent years from the Malay region, including collections from the F.M.S. Museums, Kuala Lumpur (Mr. H. M. Pendlebury), from Singapore (Mr. C. J. Saunders and Dr. C. F. Baker), from the Buitenzorg Museum (Prof. H. Karny), and from Sumatra. From the latter island I have received collections made by Mr. J. B. Corporaal, Mr. E. Jacobson, and Mr. E. Mjöberg—that made by the last-named coming to me from Dr. Yngve Sjöstedt of the Stockholm Museum. I have also received a good many *Carabidæ* from the Philippine Islands (Dr. C. F. Baker), but am only describing here one new species peculiar to them.

The undescribed material contained in these collections is so considerable that I find it impossible to do more than deal with a small portion of it in this paper, where I am describing twenty-one new species and varieties, but I shall hope to publish further descriptions later on.

*Clivina saundersi*, sp. n.

Length 8·0–9·0 mm.

Black: palpi, antennæ, and base of mandibles testaceous; two hind pairs of legs and all tarsi dark reddish.

*Head* rather narrow, eyes moderately prominent; median part of clypeus slightly emarginate, angles rounded, wings small, rounded, concave, almost reaching level of median part and separated from it by a small notch, frontal plates convex, obliquely truncate externally, and sharply rounded behind; clypeal area rugulose, with a slight transverse prominence, suture and frontal impressious both deep, joining at sides, so that the whole forms more or less of a semicircle; facial sulci deep, neck-constriction entire, punctate, but not very deep, an elongate pore on vertex, surface behind subrugose, with some pores and longitudinal striæ; labrum 7-setose, a little advanced at middle, mandibles short and wide; mentum concave beneath, the tooth carinate to near apex, strongly dilated and truncate in front; antennæ submoniliform, joint 2 hardly longer than 3. *Prothorax* convex, as long as wide, and about half as wide again as head, rather strongly contracted from base to apex, front angles projecting a little, sides faintly rounded, with conspicuous border and rugulose marginal channel, hind angles

clearly indicated by a rather deep notch in margin just in front of them, sides of base straight; median line and front transverse impression clearly marked, latter reaching margin, surface with a few transverse wrinkles, basal area granulate.

*Elytra* convex, as wide as prothorax and nearly twice as long, shoulders strongly rounded, apex rather pointed, the sides between nearly parallel, with a reflexed border and wide marginal channel, in which the seriate punctures are very conspicuous; striae fairly deep, finely crenulate, 1 to 3 free at base, 4 joining 5, and 6 joining 7, striae rather short and inconspicuous; intervals convex, 3 with four pores near stria 3, 8 carinate both at base and apex. Sterna punctate, pro-episterna finely punctate-striate, prosternal ridge not very narrow, sulcate; venter with some vague puncturation at sides, the two pores on apical segment close together. Protibiae sulcate, tridentate (including apex), mesotibiae with a short spur a little above apex.

A little wider than the widely-spread *C. castanea*, Westw. Head much more roughly sculptured; prothorax longer, more contracted in front, sides with a much wider marginal channel and a more evident tooth; elytra shorter, with wider marginal channel, the striae impunctate and only vaguely crenulate, front pore on interval 3 adjoining stria 3 instead of stria 2.

STRAITS SETTLEMENTS: Singapore (*C. J. Saunders*), 1 ex. F.M.S.: Kuala Lumpur, Bukit Cherakah (*H. M. Pendlebury*—F.M.S. Museums), 1 ex. SUMATRA: Tjinta Radja (*E. Mjöberg*—Stockholm Museum), 1 ex. Mr. Saunders has kindly allowed me to retain the type in my collection.

*Chlœnius jacobsoni*, sp. n.

Length 10.5–11.5 mm.; width 4.2–4.6 mm.

Piceous, with grey pubescence: head and prothorax dark metallic green, former often bluish, latter with border narrowly brown; joints 1 to 3 of antennæ (rest brown), palpi (apex darker), apex of elytra (fairly widely), and legs pale ferruginous.

*Head* convex, shiny, smooth, frontal foveæ short but fairly deep, eyes prominent, antennæ slender, joint 3 only sparsely pilose, as long as 4, a few minute punctures in the foveæ and across neck. *Prothorax* cordate, subconvex, half as wide again as head, and a fourth wider than long, sides with narrow reflexed border, strongly rounded and sinuate at a little distance from base, hind angles right, sharp, and projecting somewhat laterally; median line fine, placed at

bottom of a shallow furrow, transverse impressions shallow, foveæ fairly long and deep, surface coarsely punctate, but with a smooth area on each side of disk. *Elytra* convex, ovate, border rounded at shoulder, sinuate close to apex; striæ fairly deep, crenulate, intervals a little convex, moderately punctate, more closely at sides. *Underside* very finely punctate, with short pubescence, prosternal process bordered at apex but not pilose, metepisterna elongate. Upper surface of tarsi minutely punctulate, but not evidently setose, ♂ dilated joints narrow.

The fact that the prosternal process is bordered would place the species at some distance from *C. frater*, Chaud., in Chaudoir's table, but otherwise there is, both in size and colour, a strong resemblance. In the new species the prothorax is more strongly rounded at sides, the border darker, the puncturation coarser; the striæ of the elytra are deeper, the intervals more convex, the puncturation much less close and much coarser, the apical yellow patch less jagged in front and not extending forward along sides.

SUMATRA: Fort de Kock, 3000 ft. (*E. Jacobson*), 15 ex. Mr. Jacobson has presented the type to the British Museum.

*Badister sundaicus*, sp. n.

Length 5·0–6·0 mm.

Black, elytra somewhat iridescent, piceous-brown beneath, joint 1 of antennæ, palpi, labrum, clypeus, margins of prothorax, border and epipleuræ of elytra, and legs more or less testaceous, but apical joint of labial palpi fuscous except at extremity.

*Head* convex, dull and smooth, sides of front somewhat hollowed out, upper edge of left mandible deeply emarginate before apex, right mandible simple, eyes moderately prominent, apical joint of labial palpi dilated and obliquely truncate at apex. *Prothorax* convex, a third wider than head, and quite a half wider than long, base with sides strongly oblique, apex emarginate and bordered, sides gently rounded, not sinuate behind, somewhat reflexed and explanate, especially behind, hind angles obtuse and somewhat rounded; median line deeply, transverse impressions lightly, basal foveæ moderately impressed, surface smooth and moderately shiny, a little longitudinal striation along basal and apical margins. *Elytra* oval, moderately convex, half as wide again as prothorax, and as much longer than wide; rather finely striate, the striæ vaguely crenulate, scutellary striae long, intervals rather flat, but convex near apex,

3 with two well-marked pores adjoining stria 2, placed just before a half and at two-thirds, surface smooth. Micro-sculpture of head and sides of prothorax isodiametric; on disk of prothorax and elytra there are very closely placed transverse lines, just visible under a magnification of 75 diameters. *Underside* smooth.

In the form of the mandibles and coloration closely allied to *B. peltatus*, Panz. Head and prothorax both wider, the latter less constricted behind, elytra regularly oval, not dilated behind, and with the front pore on interval 3 placed further back. According to Ganglbauer the second joint of the antennæ in this genus is glabrous, but both in this and in palæarctic species I find it to be at least moderately pubescent.

JAVA : Soekaboemi and Papandajan (*G. E. Bryant*), 2 ex.; Sindang-laja (Buitenzorg Museum), 1 ex. SUMATRA : Fort de Kock (*E. Jacobson*), 7 ex. The type (Soekaboemi) is in my collection.

*Anisodactylus sjoestedti*, sp. n.

Length 10·0–11·0 mm.; width 3·5–4·0 mm.

Black, shiny, elytra iridescent: palpi, joints 1 to 3 of antennæ (rest brown), palpi, side-margin of prothorax, apical border of elytra, and legs ferruginous; a transverse spot on vertex dark red.

*Head* wide, convex, frontal foveæ moderately deep, a fine oblique line on each side between them and eyes, labrum and clypeus both emarginate, suture fine, eyes rather prominent, antennæ slender, surface minutely punctate. *Prothorax* moderately convex, quadrate, a third wider than head, and half as wide again as long, narrowly bordered throughout, base truncate, apex emarginate, sides gently and regularly rounded, a single seta on each side at apical third, hind angles obtuse and somewhat rounded; median line, transverse impressions, and basal foveæ all very shallow, surface minutely punctate, more closely along margins, basal foveæ finely subrugose. *Elytra* convex, with square shoulders and nearly parallel sides, slightly emarginate near apex, a third wider than prothorax, and rather more than a half longer than wide; striæ deep, very deep near apex, impunctate, a long scutellary stria, intervals convex, 3 with a single pore at two-fifths from apex, surface minutely punctate, much more closely on intervals 8 and 9 (as in *Pardileus*). Sterna finely, pro-episterna and venter minutely punctate.

No *Anisodactylus* has hitherto been described from S.E. Asia, and I place the species in that genus with some hesitation on account of its shiny and iridescent elytra. Of the other oriental Anisodactyline genera, *Gnathaphanus* has a ligula completely surrounded by the paraglossæ, and in *Chydæus* there is a sharp tooth in the mentum. All the main generic characters are those of *Anisodactylus*, and I see no sufficient ground for excluding this species.

SUMATRA: Fort de Kock (*E. Jacobson*), 21 ex., Medan (*E. Mjöberg*—Stockholm Museum), 4 ex. "Holländ. Indien, ? Java" (Buitenzorg Museum), 34 ex. PHILIPPINE Is.: Los Baños (*C. F. Baker*), 1 ex. The type (Fort de Kock) has been presented by Mr. Jacobson to the British Museum.

*Chydæus bakeri*, sp. n.

Length 8·5–10·0 mm.

Black: palpi dark ferruginous, tarsi piceous.

*Head* wide, convex, neck swollen, clypeal suture moderately deep, bifurcating at each end, a line running towards base of antennæ and another one to eye, clypeus slightly emarginate, bordered, eyes flat, genæ evident but very oblique, antennæ short, not reaching base of prothorax, surface smooth. *Prothorax* convex, cordate, a little wider than head and a half wider than long, extremities truncate, front angles moderately sharp and slightly projecting, sides with a reflexed border, rounded in front and sinuate a little before base, hind angles right and sharp; median line rather fine, both transverse depressions deep, basal foveæ forming a rounded depression in the angle, all margins finely punctate, front one a little vaguely, side margins more evidently, and base (especially foveæ) closely and somewhat confluent, disk practically smooth. *Elytra* convex, ovate, quite a third wider than prothorax, and two-thirds longer than wide, shoulders square, apex widely though shallowly emarginate on each side; striæ fine but clearly cut, impunctate, deeper near apex; intervals flat, more convex near apex, 3 impunctate and with a small knob on outer margin near apex; surface smooth, with a faintly impressed microsculpture of moderately transverse meshes, hardly visible on head and prothorax. *Underside* practically smooth, prosternal process unbordered, metasternum and metepisterna finely punctate, latter long and narrow.

Smaller than *C. bedeli*, Tchitch., with a cotype of which species I have compared it. Head with a bifurcate impression on each side of front, instead of a puncture, antennæ

shorter; prothorax with narrower border, less strongly rounded at sides, hind angles not projecting laterally; elytra more parallel, with finer striæ, less pointed at apex; in the ♂, joint 1 of the protarsi is relatively larger. This is the third species of the genus to be described, the other two being confined to the Central and North-eastern Himalayas.

PHILIPPINE Is.: Baguio, a hill-station in Benguet Province, Luzon (*C. F. Baker*), 9 ex., ♂ ♀. Dr. Baker kindly allows me to retain the type in my collection.

*Trichotichnus javanus*, sp. n.

Length 8.0–8.5 mm.

Black, slightly iridescent, shiny: side-border of prothorax, palpi, antennæ, and legs ferruginous.

*Head* convex, moderately wide, no frontal foveæ, clypeal suture and oblique lines to eyes very deep, eyes not prominent, antennæ short, submoniliform near apex, surface smooth, with a few vague punctures near eyes. *Prothorax* convex, quadrate, a third wider than head, and as much wider than long, extremities truncate, sides finely bordered, rounded in front, then straight to base, which is rather wider than apex, hind angles somewhat obtuse, but very little rounded; median line short and fine, apparent on disk only, transverse basal impression and foveæ shallow, latter rounded, surface smooth, with some fine puncturation (rather variable in amount) along sides and base. *Elytra* convex, oval, a third wider than prothorax, and a half longer than wide, sides slightly sinuate at a third and close to apex; striæ moderately impressed, but somewhat variable in depth, impunctate, an umbilicate pore at point where 2 and scutellary striae join, intervals a little convex on disk, more so near apex, 3 with a small pore at two-fifths from apex, adjoining stria 2, surface smooth, with a vague ill-defined microsculpture on elytra.

Closely allied to *T. birmanicus*, Bates, but a little larger. The head similar, the prothorax with its sides straight behind and with obtuse hind angles, the elytra less deeply striate.

JAVA: Gedeh, 5000 ft. (*G. E. Bryant*), 2 ex. (my coll.—type); Malabar 5 ex., Palabuan Ratu 1 ex., "Holländ. Indien" 1 ex. (all Buitenzorg Museum); Preanger, Tjigembong (*J. B. Corporaal*), 1 ex. KRAKATAU (No. 36), 8 ex. (Buitenzorg Museum). BURU: Station 5 (*L. J. Toxopeus*), 1 ex.

*Trichotichnus sumatrensis*, sp. n.

Length 8·5–9·0 mm.

This species is rather larger than *T. javanus*, but otherwise agrees in most of its characters. I should have regarded it as nothing more than a variety, but for the different form of the prothorax. The shape of this is similar, but the basal foveæ, though not deeply impressed, are linear rather than rounded, and there is an almost total absence of puncturation.

SUMATRA: Sibolangit (*E. Mjöberg*—Stockholm Museum), 1 ex.; Fort de Kock, 3000 ft., 2 ex., and Gunung Singgalang, 6000 ft., 3 ex. (both *E. Jacobson*). The type (Gunung Singgalang) has been presented by Mr. Jacobson to the British Museum.

*Anoplogenius incisus*, sp. n.

Length 7·0–8·0 mm.

Black, shiny, upperside iridescent, underside piceous, venter brown: palpi, joints 1 and 2 of antennæ (rest piceous), legs, side margins of prothorax and elytra, and apex of latter ferruginous. The colour on the elytra is rather pale and covers apical sixth, extending somewhat forward along intervals 7 to 9, occasionally reaching shoulder along 7.

*Head* wide, convex, clypeal suture deep, continued on each side to eye by an even deeper oblique groove, clypeus uneven, depressed across middle and at sides, its front margin notched on each side, eyes prominent, antennæ fairly long. *Prothorax* convex, quadrate, a third wider than head, as much wider than long, and widest a little before middle, sides gently rounded, hind angles obtuse and rounded, but quite distinct; median line and transverse impressions faint, basal foveæ rounded, moderately deep, their surface and sometimes whole of base rather finely and closely punctate, surface otherwise smooth. *Elytra* convex, sides nearly parallel, but slightly dilated behind, a third wider than prothorax, two-thirds longer than wide; striæ impunctate, very clearly incised, but deep only at sides and apex, intervals nearly flat on disk, convex at sides and behind, 2 with an umbilicate pore at base, 3 with a pore at two-thirds adjoining stria 2, pores of marginal series large, the series widely interrupted. Surface smooth and slightly sericeous, the microsculpture very fine and consisting in isodiametric meshes on the head and very closely placed



transverse lines on prothorax and elytra. *Underside* smooth, prosternal process setiferous, joint 4 of tarsi strongly emarginate, in ♂ pro- and mesotarsi bilobed.

Very near *A. cyanescens*, Hope, but smaller. Head with deeper clypeal suture; prothorax with pale border narrower, hind angles more distinct and less rounded, basal foveæ more evidently punctate; elytra with rather finer striæ and less conspicuous pale border.

SUMATRA: Fort de Kock (*E. Jacobson*) 11 ex., Tjinta Radja (*E. Mjöberg*—Stockholm Museum) 1 ex., Nias I. (Brit. Mus.) 1 ex. JAVA: Batavia (*C. W. Andrews*—Brit. Mus.) 7 ex., "Java" (Brit. Mus.) 6 ex., "Holländ-Ind., ? Java" (Buitenzorg Mus.) 1 ex. LOMBOK, 5 ex.; CELEBES, 2 ex.; NEW GUINEA, Dorey, 2 ex. (all *Wallace*—Brit. Mus.). The type (Fort de Kock) has been presented by Mr. Jacobson to the British Museum.

*Odacantha tenuis*, sp. n.

Length 8.0 mm.; width 1.75 mm.

Black, shiny: palpi, antennæ, base of femora, tibiæ, and tarsi more or less ferruginous; elytra with an elongate apical spot on interval 5 yellowish white.

*Head* very convex, smooth both above and beneath, obliquely and gradually narrowed to the constricted condyliform neck, frontal foveæ small but fairly deep, eyes prominent, antennæ slender. *Prothorax* convex, narrower than head, and rather more than twice as long as wide, strongly contracted in front, constricted behind, widest a little behind middle, lateral suture just visible, surface smooth with some faint transverse striation, basal area uneven, with a few punctures at sides. *Elytra* convex, depressed behind base, a little wider than head and about twice as long as wide, shoulders oblique, sides nearly parallel, but very slightly dilated behind and widest at apical third, truncate behind, the truncature feebly emarginate on each side, the outer angle dentate, but not acute; finely striate-punctate, the outer rows of punctures deeper than the inner ones, and all much finer behind, a scutellary stria present, formed by a few punctures, 4 and 5 widening out to enclose the somewhat raised apical spot and then disappearing; intervals flat, 3 with four setiferous pores, first in the basal depression, second before middle, the other two not far from apex, surface smooth, without any apparent micro-sculpture.

A little longer than *C. distigma*, Chaud., the prothorax

black, the elytral spots smaller and narrower. Head wider and more rapidly narrowed to neck; prothorax similar, though rather more dilated at middle; elytra longer and more parallel, striate-punctate, a tooth at outer angle of apical truncature, shiny and without evident microsculpture.

BORNEO: Brunei (*Waterstradt*), 1 ex., for which I am indebted to Mr. T. G. Sloane.

*Var. rubripes*, nov.

This variety differs from the type-form in having the legs entirely ferruginous, the colour a little lighter. There is rather more puncturation on the prothorax at sides of base and a few large punctures on the under surface. The punctures forming the elytral striæ are also a little deeper.

SUMATRA: Medan 2 ex., Tjinta Radja 1 ex. (all *E. Mjöberg*—Stockholm Museum). The type of the variety is in the Stockholm Museum.

*Var. linea*, nov.

The apical spot is four times as long as wide, as against rather less than twice, and the adjacent striæ enclose it in the same way. The sides of the prothorax are distinctly punctate near base, as in *var. rubripes*, but in all other respects the variety resembles the type-form.

BORNEO: Banguay Island (*Waterstradt*), 1 ex. I am also indebted to Mr. Sloane for this specimen.

*Creagris lineola*, sp. n.

Length 7·5–8·0 mm.

Ferruginous-red, pubescent; elytra black, an elongate central ferruginous spot on each, covering intervals 3 to 7, quite half as long as elytra on 7, diminishing to a third on 3, sometimes continuing vaguely backwards on 5, and curving inwards near apex to sutural angle.

*Head* convex, punctate, with small rounded foveæ, contracted behind, with a somewhat constricted neck, eyes rather prominent, genæ evident, oblique, antennæ incrassate, ligula wide and deeply grooved beneath at apex, mentum bisetose, lobes long and sharp, tooth long, thin, and very sharp, bisetose at basal third, labial palpi with penultimate joint dilated, triangular, inwardly bisetose, last joint subcylindrical, rounded at apex, last joint of maxillaries strongly dilated and obliquely truncate. *Prothorax* convex, nearly twice as wide as long and a little wider than head, base

somewhat produced at middle, sides somewhat explanate, gently rounded in front and sinuate at a third from base, hind angles right but rounded; median line and transverse impressions slight, basal foveæ small but fairly deep, surface somewhat coarsely punctate. *Elytra* somewhat depressed, a half wider than prothorax and twice as long as wide, sides nearly parallel, apex rather squarely truncate; 7 developed and finely punctate striæ, a hardly interrupted row of umbilicate punctures near margin, outside of which, on basal third, are indications of a further stria, intervals moderately convex, 6 a little narrower and more convex than the others, 8 somewhat wider, surface with rather coarse punctures, like those of head and prothorax. Under surface more finely punctate than upper, rather smoother down median line of body.

Narrower than *C. labrosa*, Nietn., and otherwise coloured. Head narrower and with frontal foveæ much smaller; prothorax narrower and with only a shallow median line; elytra more elongate and parallel, with rather deeper striæ and more convex intervals. The fourth joint of the protarsi is less conspicuously bilobed; in the two hind pairs of legs it is deeply emarginate.

SUMATRA: Medan (*E. Mjöberg*—Stockholm Museum), 1 ex.; Fort de Kock (*E. Jacobson*—type), 1 ex. SELANGOR: Kuala Lumpur (*H. M. Pendlebury*—F.M.S. Museums), 1 ex. at light. Mr. Jacobson has presented the type to the British Museum.

*Orthogonius saundersi*, sp. n.

Length 13·0–14·0 mm.; width 5·0–5·75 mm.

Black, shiny; palpi and procoxæ brownish, tarsi piceous.

*Head* small, convex, impunctate, frontal foveæ punctiform, surface somewhat uneven, sometimes strigose between eyes, clypeal suture deep, middle of clypeus just in front of it raised into two small knobs, sometimes obsolete, eyes prominent, antennæ rather stout and short, reaching just beyond base of prothorax, ligula bisetose. *Prothorax* convex, three-fourths wider than head and as much wider than long, base faintly bisinuate, bordered, apex faintly emarginate, strongly contracted in front, with the front angles completely rounded away, so that base is very much wider than apex, hind angles a little obtuse and slightly rounded, sides hardly bordered, rounded, explanate, more widely behind; median line faint, front transverse impression short, deep, uneven, hind one shallow, two rounded foveæ on each side

of base, with a somewhat raised area between them, surface impunctate but a little uneven, with a few fine punctures in marginal channel. *Elytra* convex, just wider than prothorax, two-thirds longer than wide, sides very gently and unevenly rounded, apex obliquely truncate, with outer angle rounded; finely punctate-striate, stria 8 much deeper than the others; intervals nearly flat, 8 convex, 4, 6, and 8 a little wider, 7 a little narrower near base, 3 tripunctate, at a fourth, a half, and close to apex, 3, 5, and 7 with a few minute punctures, surface otherwise smooth, without evident microsculpture. *Underside* smooth, prosternal process unbordered; protibiae produced externally and forming a tooth at apex, mesotibiae not dilated, metatibiae with short, undilated, and not very sharp spurs, all tarsi with joint 4 bilobed and claws pectinate.

Nearly allied to *O. politus*, Chaud., but smaller and narrower. Head with much more uneven surface, frontal foveæ punctiform; prothorax more uneven, more contracted in front, side-margins punctate, two foveæ on each side at base; clytra similarly truncate, but narrower, finely punctate-striate instead of very finely striate-punctate.

SINGAPORE: 6 ex. (*C. J. Saunders*), 4 ex. (*C. F. Baker*). The type is in my collection. One of Mr. Saunders's examples is marked "jungle."

*Catascopus phlogops*, sp. n.

Length 12·0-13·0 mm.

Black, body beneath with a fine metallic tinge; upper surface (except buccal organs) metallic green, elytra somewhat sericeous, with an elongate purple patch behind on intervals 4 to 8.

*Head* large, the neck very clearly constricted, frontal foveæ moderately deep, longitudinally striate, surface otherwise practically smooth and impunctate. *Prothorax* rather small, hardly as wide as head, cordate, nearly as long as wide, front angles projecting a little and not much rounded, sides only gently rounded, sinuate at basal third, the two setæ on the border, the front pore making the sides almost angulate at widest point, hind angles about right, a little rounded and somewhat reflexed; median line very deep, not reaching front margin, basal transverse impression and foveæ fairly deep, surface practically smooth, a little cross-striation only, with a few microscopical punctures. *Elytra* subquadrate, moderately convex, not quite two-thirds wider than prothorax, half as long again as wide, shoulders square,

sides slightly dilated behind middle, where there is a depression on intervals 8 and 9, apex truncate and bi-emarginate, outer angle spiniform, extreme apex truncate opposite intervals 1 and 2, and, as the elytra are slightly dehiscent, the four angles of this truncature all sharp; striæ moderately deep, punctate, intervals a little convex, 5 and 7 narrow, subcarinate, 3 a little narrower than the others at base, with three pores. *Underside* smooth and glabrous, except prosternum, which is slightly punctate and pubescent.

Allied to *C. versicolor*, Saund., but that species is of a dull bluish green, the elytra suffused with a cupreous tint, intervals 7 to 9 bright green, the border blue, the head with a few fine punctures and only a slight constriction of the neck, the spine at the outer angle of the elytral truncature much smaller.

SUMATRA: G. Talang (my collection—type) 1 ex., Kota Tjane (*E. Mjöberg*—Stockholm Museum) 1 ex. JOMORE (*H. W. Ridley*—Brit. Mus.), 1 ex.

*Pericalus guttatus*, Chev., var. *violaceus*, nov.

This is a colour-variety only of Chevrolat's well-known species, but I have seen a good many examples during recent years, and, as it is strikingly different from the type-form, I think it is as well to give it a name. Instead of being black with a faint bluish tinge, the elytra are of a fairly bright violet-colour, and some of the dull orange spots which go to form the pattern are almost always wanting, noticeably those on intervals 5, 6, and 7 in front and that on interval 2 behind.

MALAY PENINSULA (*Dr. M. Cameron*), 2 ex., including type, in my collection. SELANGOR-PAHANG: Semangko Pass, 2700 ft. (Raffles Museum, Singapore), 1 ex.; The Gap, 2700 ft., 2 ex. (F.M.S. Museums). PERAK: Batang-Padang, Jor Camp, 1800 ft., 1 ex., and Sungeit Ringat, 3500 ft., 1 ex. (both *H. M. Pendlebury*—F.M.S. Museums); "Perak" (*Doherty*—Brit. Mus.), 1 ex. SUMATRA: Fort de Kock, 3000 ft. (*E. Jacobson*), 2 ex., "under rotten bark of *Erythrina lithosperma*." "Holländ. Indien" (Buitenzorg Museum), 3 ex.

*Pericalus funestus*, sp. n.

Length 13·0–14·0 mm.

Black, joints 5 to 11 of antennæ, palpi, and tarsi brownish,

elytra with a very faint blue or purple tinge and a pattern formed of three irregular transverse dull orange lines, the first just behind a third from base on intervals 3 to 7, second just behind middle on intervals 4 to 6, third just behind two-thirds on intervals 2, 3, and 7, but on some intervals the colour is occasionally wanting.

*Head* wide, frontal foveæ shallow, neck subconstricted, mandibles long, eyes prominent, longitudinally striate, clypeus slightly emarginate in the middle, the sides deeply, a narrow area along median line and occiput irregularly rugose. *Prothorax* cordate, moderately convex, just wider than head and a fourth wider than long, front angles projecting but rounded, sides unbordered, rather widely explanate, and a little reflexed, strongly rounded in front, where the anterior marginal pore forms almost an angle, and sinuate at basal third, the hind angles about right, reflexed, but hardly projecting, a short raised line within them, directed towards middle: median line, transverse impressions, and basal foveæ all moderately deep, surface transversely rugose-striate, more finely along the explanate margin. *Elytra* convex, ovate, half as wide again as prothorax and as much longer than wide, shoulders projecting a little forwards, sides behind them rather sinuate, dilated behind and widest behind middle, apex somewhat narrowly truncate, outer angle sharply dentate, inner one rounded, so that there is a re-entrant angle at extreme apex; striæ deep, impunctate, intervals convex, with three pores on 3, near base and middle, and quite close to apex; surface moderately shiny, with a microsculpture of fine, not very closely placed, transverse lines. Underside smooth and shiny, though with some minute pores and pubescence, prosternum with some longer setæ.

A little larger than *P. guttatus*, Chev., and with a different pattern on elytra, the head with deeper but less numerous striæ, the prothorax more strongly rounded in front, its sides sinuate further from base, elytra relatively longer, more evidently sinuate behind shoulder, the second pore on interval 3 placed further forward, the sutural angle rounded instead of dentate.

SUMATRA: Gunung Singgalang, 5800 ft. (*E. Jacobson*), 4 ex. Mr. Jacobson has presented the type to the British Museum.

*Pericalus depressus*, sp. n.

Length 7·0–9·0 mm.

Head and prothorax metallic green, elytra bright green along sutural area and side-margins, otherwise purple with a

dull yellow pattern, as in *P. xanthopus* and *spiniger*, the front spot longer, metasternum and venter dark blue, joint 1 of antennæ, basal joints of palpi, labrum, femora, and tibiæ more or less ferruginous, rest of antennæ and palpi, and tarsi brownish.

*Head* wide, frontal foveæ very shallow, eyes prominent, surface finely and densely rugose-punctate, longitudinally substriate in front. *Prothorax* subcordate, a little wider than long, three-fourths as wide as head, sides gently rounded in front, sinuate at basal third, hind angles projecting somewhat both at sides and behind, though not very sharp; median line moderate, transverse impressions and foveæ all deep, surface very distinctly transversely striate. *Elytra* depressed, ovate, twice as wide as prothorax and nearly half as long again as wide, strongly dilated behind and widest behind middle, the apical truncature with a sharp tooth at both outer and inner angles; striæ fairly deep, minutely punctate, intervals moderately convex, 3 with three clearly marked pores, at a sixth and a fourth adjoining striæ 3, and at three-fifths adjoining stria 2, another pore almost in apical angle, surface dull, with a very visible microsculpture of transverse lines. Underside minutely punctate and pubescent, some longer setæ on prosternum.

Agreeing in many characters with *P. xanthopus*, but larger. Head more closely and densely rugose-punctate, prothorax similar in shape, but transversely striate, the front transverse impression deeper, elytra similarly coloured, but flatter and more dilated behind, front spot more elongate along intervals 4 and 5.

PERAK: Malacca (*Doherty*—my coll.), 5 ex., including type, and 9 ex. (*Doherty*—Brit. Mus.); Batang Padang, Jor Camp, 1800 ft. (*H. M. Pendlebury*—F.M.S. Museums), 2 ex. SINGAPORE (Brit. Mus.), 2 ex. PAHANG: Gunong Tahan (*H. C. Robinson*—Brit. Mus.), 1 ex. BORNEO: Sandakan (*C. F. Baker*), 3 ex.; Brunei (*Waterstradt*), 1 ex.; Baram dist. (*Hose Coll.*—Cambridge Zool. Mus.), 1 ex.; Martapura (*Doherty*—Brit. Mus.), 4 ex.; N.W. Borneo (Brit. Mus.), 1 ex. SUMATRA: Sibolangit, 3 ex., Boschr-Bandar, 3 ex., and Lau Rakit, 1 ex. (all *J. B. Corporaal*); Medan (*E. Mjöberg*—Stockholm Museum), 1 ex.

*Pericalus spiniger*, sp. n.

Length 8.0–8.5 mm.

Dark æneous, venter black, head and prothorax lighter and to some extent cupreous; joints 1 to 4 of antennæ, palpi, and labrum ferruginous, femora and elytral pattern

flavous, rest of antennæ brown. Each elytron has two spots extending approximately from stria 2 to 8, the anterior one emarginate in front on intervals 5 and 6, the colour on 4 much longer than on the rest, posterior one smaller, emarginate on some intervals behind. The pattern is much the same as in *P. xanthopus*.

*Head* as wide as long, frontal foveæ small and near together, eyes very large and prominent, antennæ long and slender, surface finely rugose-vermiculate, longitudinally striate between eyes. *Prothorax* quadrate, moderately convex, only a little wider than long and about two-thirds as wide as head, slightly and gradually contracted towards base, sides nearly straight, sinuate at basal fifth, hind angles acute, projecting laterally; median line fine, basal depression and foveæ fairly deep, surface very clearly transversely striate. *Elytra* moderately convex, shoulders rather square, sides gently rounded, apex obliquely truncate, both ends of truncature with a sharp slender spine, the apical longer than the outer one, which is directed a little outwards; striæ fairly deep, crenulate, 2 and 3 nearly or quite uniting for a short distance at apical fourth, where there is a setiferous pore, interval 3 with three pores on basal half adjoining stria 3 and another close to apex, marginal series with some very long setæ, surface shining with a microsculpture of fine, not very closely placed transverse lines, hardly forming a distinct reticulation. Underside minutely punctate and pubescent.

Wider and larger than *P. xanthopus*, Schaum, the prothorax with straight sides and striate surface, the elytra shining and with more irregular pattern. The species differs from Chaudoir's *P. figuratus* and *picturatus*, with which I compared examples at Rennes.

BATCHIAN : Labocan (*Doherty*), 5 ex. in my collection.

*Holcoderus smaragdinus*, sp. n.

Length 6.5–7.0 mm.

Bright blue, green-blue, or bright green above, elytra sericeous; femora and underside of head and prothorax as upper surface, but darker; antennæ, palpi, rest of legs, and venter piceous-black.

*Head* fairly wide, striate at sides in front, frontal foveæ and neck-constriction both shallow, clypeus very finely, rest of upper surface more coarsely but not closely punctate, eyes large and moderately prominent, antennæ short and stout, the joints gradually increasing in size towards apex. *Prothorax* subquadrate, moderately convex, just wider than



head and a little wider than long, base produced backwards at middle, a little narrower than apex, front and hind angles right and sharp, sides finely bordered, gently rounded in front, though the front marginal pore makes almost an angle at widest point, and slightly sinuate before base; median line not very wide, equally deep throughout (in the type a little wider at base), transverse impressions shallow, basal foveæ moderately deep, surface transversely rugose-striate, and rather finely but not closely punctate. *Elytra* flat, with parallel sides, half as wide again as prothorax and a little less than twice as long as wide, shoulders rounded, apex truncate moderately emarginate on each side, with both inner and outer angles rounded; fairly deeply punctate-striate, the punctures much larger near shoulders and at sides, intervals rather flat on disk, more convex at sides, 7 a little raised along inner margin, 3 with three pores at a fourth, three-fifths, and close to apex, surface with an irregular line of minute punctures down the centre of each and with a sericeous appearance due to the distinct microsculpture, which is formed by a reticulation of very nearly isodiametric meshes. The underside is smooth, with exception of prosternum and episterna, which are moderately punctate.

Smaller and much flatter than *H. gracilis*, Oberth., the head punctate, prothorax similar in shape, though more produced behind, the median furrow not dilated in front, elytra depressed and sericeous. In *gracilis* the elytra are much more shiny, the microsculpture being much finer and formed mostly by strongly transverse meshes.

BORNEO: W. Sarawak, Quop (*G. E. Bryant*), 2 ex. SUMATRA, 1 ex. TONKIN: Hoabinh (*R. Vitalis de Salvaza*), 1 ex. The type, a blue example from Quop, is in my collection.

*Dolichoctis lunigera*, sp. n.

Length 5·0–6·0 mm.

Black: apex of palpi, basal joints of antennæ (rest brown), side margins and sometimes epipleuræ of prothorax and elytra, two spots on each elytron, the front one crescent-shaped, concave forwards, from stria 2 to 8, hind one transverse, on intervals 3 to 5, knees, apex of tibiæ, and tarsi ferruginous. Either or both spots may be ill defined or even entirely wanting.

*Head* small, dull, smooth, convex, frontal foveæ oblique and rather slight, eyes large and prominent, antennæ slender, reaching base of prothorax. *Prothorax* convex, a third wider

than head and nearly a half wider than long, base truncate with its sides a little oblique, apex moderately emarginate, front angles projecting forwards and only slightly rounded, sides unbordered, reflexed, an explanate margin, wider behind, gently rounded, with only a trace of sinuation before hind angles, which are slightly obtuse and rounded, front lateral seta wanting, hind one on the angle; median line and transverse basal impression both clearly marked, basal foveæ elongate and fairly deep, surface smooth and shining. *Elytra* convex, ovate, a half wider than prothorax and two-thirds longer than wide, compressed at sides behind shoulder, obliquely truncate at apex, with a small re-entrant angle at suture; striæ very fine, a little deeper at sides and near apex, scutellary stria obsolete, intervals flat on disk, more convex at sides and behind, 3 with two minute setiferous pores on apical third, 3 to 7 uniting behind in a raised setiferous boss opposite stria 3, surface smooth. Microsculpture of head isodiametric, a reticulation of transverse meshes on prothorax, and strongly transverse meshes on elytra. The characters of the species in this genus are subject to great individual variation.

As long as *D. tetracolon*, Chaud., but narrower, the front spot on the elytra crescent-shaped. Head with longer antennæ; prothorax narrower, its sides less explanate in front and with the front lateral setæ wanting; elytra more finely striate on disk and with a small raised boss behind.

SUMATRA: Gunong Singgalang, 6000 ft. (*E. Jacobson*), many ex.; Medan (*E. Mjöberg*—Stockholm Museum), 1 small and immature ex. The type has been presented by Mr. Jacobson to the British Museum.

*Lachnoderma tricolor*, sp. n.

Length 8.0 mm.; width 2.75 mm.

Black, somewhat shining: head and prothorax red, elytra blue, the whole body covered with an erect and rather long light grey pubescence, not sufficiently dense to conceal the integument.

*Head* moderately convex, contracted behind, neck somewhat constricted, frontal foveæ moderately deep, uneven, clypeus slightly emarginate, labrum somewhat concave, arcuate in front, a slight ridge down centre, eyes very prominent, antennæ fairly long and a little shiny, surface (including labrum) finely and irregularly punctate. *Prothorax* cordate, slightly convex, a little wider than head and not quite a half wider than long, base produced backwards (as in

*Lebia*), apex a little emarginate and only slightly narrower than base, front angles strongly rounded, sides hardly bordered, explanate and moderately reflexed, strongly rounded, almost angulate in front, rather sharply sinuate at a fourth from base, the margin fringed with conspicuous long hairs, hind angles sharp, reflexed, slightly acute, and projecting laterally; median line shallow in front, deeper at middle, widening out behind, with its sides coarsely punctate, transverse impressions and foveæ all fairly deep, surface uneven at sides, disk very finely, base and apex more coarsely punctate. *Elytra* convex, with square shoulders and nearly parallel sides, widening a little behind middle, three-quarters wider than prothorax, and a half longer than wide, apex subtruncate, but with outer angles quite rounded away; striate-punctate, the punctures fairly large and rather irregular, a scutellary stria present; intervals flat, the odd ones (except 1) with four or five long erect setæ; surface irregularly rugose-punctate, the general pubescence making the setæ on odd intervals difficult to locate, no microsculpture. Underside more shiny and less pubescent, especially along middle line of body; fourth tarsal joint large, bilobed, and clothed beneath with a dense pad of pale hairs, claws very distinctly pectinate, dilated at base, with about eight fairly long and equal teeth on each side.

Exactly similar in shape to *L. biguttatum*, Bates, but much smaller and quite otherwise coloured. Head with a less distinct ridge on labrum; prothorax with sides somewhat less strongly rounded and more nearly angulate; elytra striate-punctate instead of punctate-striate, the intervals consequently flatter, surface rather more rugose and more evidently pubescent.

INDIA: Pusa, 1 ex. at light (Pusa Research Inst.). SINGAPORE (*C. J. Saunders*—type), 1 ex. Mr. Saunders has kindly allowed me to retain the type in my collection.

XXXV.—*The Sexual Organs of the Freshwater Oligochæte Naidium breviseta* (*A. G. Bourne*). By J. STEPHENSON, M.B., D.Sc., Lecturer in Zoology, Edinburgh University.

THE predominant mode of reproduction in the Oligochæte family of the Naididæ is the asexual, by fission; so much so that in a number of genera the sexual organs have never yet been observed. The genus *Naidium* is one of these; and I

owe the opportunity of filling up this blank in our knowledge to the kindness of Mr. K. S. Padmanabha Aiyer, of the Maharajah's College of Science, Trivandrum, who recently sent me some sexual specimens of *Naidium breviseta*, together with a description of the penial setæ, and suggested that I should describe the reproductive apparatus. Three of the four specimens received were suitable for sectioning; these were cut longitudinally. In one series the sections are sagittal; in one frontal (in a horizontal plane); in the third the sections are somewhat oblique, but more horizontal than vertical.

The worm was originally described briefly by Bourne (1891), from specimens which he found in Madras; it was not met with again till last year, when Aiyer, who found it in Trivandrum, gave a more complete account of its anatomy in this journal (1925). Mr. Aiyer remarks, in a letter which accompanied the present specimens, that sexual individuals occur only very rarely; those which he sent were obtained from a laboratory culture which had been kept upwards of seven weeks.

### *Description of the Specimens.*

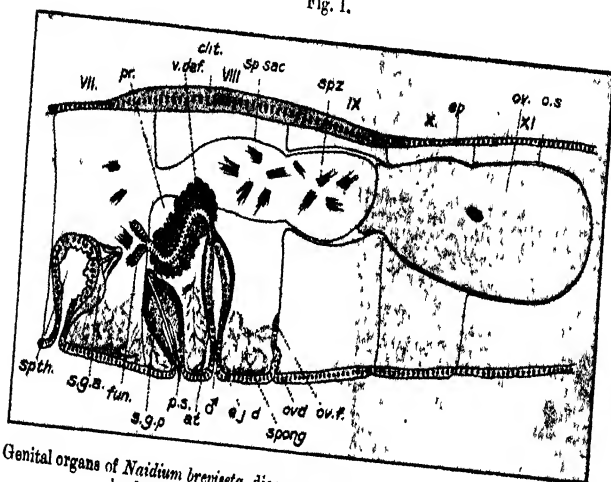
The *prostomium* has the form of a bluntly pointed equilateral triangle, or perhaps is a trifle more elongated than this comparison would imply.

The *calomic corpuscles* are one of the distinctive features of the species. In the intact specimen they are of a dense black by transmitted light; in sections they are seen to be irregular masses, of varying size, of greenish-grey granules. The individual granules are spherical in form and of various sizes, from mere specks up to  $4\mu$  in diameter. Single granules occur free in the body-cavity; there are also small clusters consisting of a few grains, and larger ones which measure up to  $20\mu$  in longest diameter. Many are of quite irregular shape, and are disintegrating; others are more regular, and are apparently still contained within the original cell-membrane; but of still existing cytoplasm there is very little trace in any. The corpuscles are similar in constitution to the chloragogen cells of the gut, and are obviously derived from these—are chloragogen cells in which the granules or droplets have attained a large size, in which the cytoplasm has disappeared, and which have become detached. In one of the three specimens the corpuscles are numerous; another is free from them—at most there are only a few fragments; in the third also they are in small numbers.

The *clitellum* extends from the level of the setæ of segment vii. to furrow 9/10 ( $=2\frac{1}{4}$ ), or even gets slightly on to segment x. It is absent in the mid-ventral region in the anterior portion of its extent, and only slightly marked in the same region behind.

On the floor of the genital segments (vii. and viii.) there is a quantity of loose *spongy tissue* (figs. 1 and 3, *spong.*), which forms a layer 30–40  $\mu$  thick. It consists of a number of very fine fibrillæ, in which are only a few nuclei.

Fig. 1.



Genital organs of *Naidium breviseta*, diagrammatic. In segment vii. the anterior setal gland is seen behind (in this position) the spermatheca.

*at.*, atrium; *clit.*, clitellum; *ej.d.*, ejaculatory duct; *ep.*, surface epithelium; *fun.*, male funnel; *o.s.*, ovisac; *ovd.*, cells possibly representing oviduct; *ov.f.*, cells possibly representing ovarian funnel; *pr.*, prostate; *p.s.*, penial seta; *s.g.a.*, anterior setal gland; *s.g.p.*, posterior setal gland; *spong.*, spongy tissue on the floor of segments vii. and viii.; *sp.sac.*, sperm-sac; *spth.*, spermatheca; *spz.*, spermatozoa in wisps in sperm-sac; *v.def.*, vas deferens;  $\delta$ , male pore.

The *testes* have disappeared in all three specimens; they were doubtless situated in segment vii., in which male funnels as well as some wisps of free spermatozoa are found.

The *seminal vesicle* or *sperm-sac* is single, and occupies segments viii. and ix., in one specimen extending into x. (fig. 1, *sp.sac.*). It contains bundles of ripe spermatozoa (*spz.*), and sometimes the characteristic cœlomic corpuscles also; large blood-vessels run on its wall. The *sac.*, originally a backward pouching of septum 7/8, extends backwards (as

usual in the Naididæ) within the anterior part of the ovisac, which is a similar backward pouching of septum 8/9; it has therefore a double wall in its hinder portion—its own and that of the ovisac. In some sections there is no apparent separation between the sperm-masses of the sperm-sac and the yolk-spherules of the ovum behind them in the ovisac; the hinder end of the sperm-sac would appear to have given way or disintegrated.

The *male funnels* (*fun.*) on the anterior face of septum 7/8, at about half the height of the segment, form small cups  $50\mu$  or less in diameter, of cubical or slightly columnar ciliated cells; a bundle of aggregated spermatozoa is seen at the entrance to the cup.

The *vas deferens* (*v.def.*) in segment viii. is continued backwards from the funnel; perforating the septum immediately, it takes the form of an S, the first bend being downwards, the second upwards. It is a narrow tube, closely surrounded in its whole length by a considerable mass of "prostatic" cells (*pr.*); these are of varied form, in general somewhat elongated, irregularly arranged, with deeply staining cytoplasm and hence very conspicuous.

The male duct is continued as the *atrium* (*at.*), an ovoid chamber, about  $80\mu$  long and  $36\mu$  wide, with its long axis vertical; it has a lining of approximately cubical though rather irregular epithelium; outside this is a thick muscular coat and a peritoneal investment with well-marked oval nuclei. Its lumen is small; the vas deferens enters at its upper pole, and it is continued below into the ejaculatory duct (*ej.d.*). This is a vertically disposed cylindrical tube,  $60\mu$  long and  $16\mu$  in diameter, lined by a cubical epithelium; the two ducts converge from each side to open underneath the ventral nerve-cord.

The two male ducts open in common. As I do not remember that this arrangement has hitherto been found in the Naididæ, I give a figure (fig. 3) of a horizontal section near the ventral body-wall; the ducts unite well within the body-wall (about  $40\mu$  from the surface); the common chamber so formed is of irregular contour and is rather wider than long, measuring 65 by  $45\mu$ , or nearer the surface (where it is shown in the fig., ♂) 88 by  $56\mu$ . In the other two series of sections reconstruction gives a similar result, perhaps best expressed by saying that both ejaculatory ducts open close together into a common pit, elongated in a transverse direction, in which its extent is  $70\text{--}80\mu$ .

The *ovaries*, like the testes, have disappeared in all the specimens; they are presumably situated in segment viii.

Though all the specimens are well advanced in sexual maturity, only doubtful traces of female funnels and ducts could be made out; in two cases (out of six possible) there appeared to be a small aggregation of cubical cells (fig. 1, *ov.f.*) on the anterior face of septum 8/9, and this in one case seemed to be connected to the surface by a small irregular mass of cells (*ovd.*).

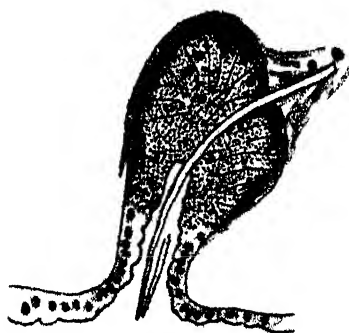
The ovisac (*o.s.*) is single, and, extending backwards from septum 8/9, of which it is a backward pouching, it reaches segment xi. or xii. Its anterior portion is occupied by the sperm-sac, its posterior (from the hinder part of ix. to xi. or from x. to xii.) contains an ovum (*ov.*), apparently one only, in the stage reached by the present specimens. In these the whole posterior part of the sac is occupied by a mass of small spherical loosely aggregated eosin-staining yolk-granules, in the middle of which is a small mass of ooplasm. The mass of yolk-granules may be as much as  $580\mu$  in length and  $230\mu$  in width—in other words, it may take up nearly the whole width of the worm. It seems unlikely that such eggs can be extruded through the very rudimentary female ducts, even if the group of cells (*ovd.*) mentioned above is really the duct, and even if they occur in all sexual individuals; it appears probable that the occurrence of a sexual stage brings the worm's life to an end, and that the ovum escapes by the disintegration of the parent's body.

The spermathecae (*spth.*) are paired ovoid sacs,  $70$  by  $60\mu$ , situated anteriorly in segment vii. The epithelium of the sac is irregular, high and of a columnar form in places, lower in others; a muscular investment exists, but it is very sparse. The sac is prolonged at its ectal end into a short tubular duct,  $60\mu$  in length and  $25\mu$  in diameter, lined by an approximately cubical epithelium. The ducts, one on each side of the ventral nerve-cord, converge to open in common underneath it.

This common aperture, anteriorly situated in segment vii., is shown in the horizontal section just within the body-wall (fig. 3, *com.ap.*); it is wider transversely than longitudinally, and includes also the pore of the anterior setal gland (*vide infra*). It might perhaps be described in two of the three specimens (*cf.* description of the male aperture) as a transversely elongated mid-ventral pit,  $60$ – $100\mu$  in transverse extent; in the third it is rather narrower (fig. 8). The anterior setal gland opens into it close outside the right spermathecal duct. In two series of sections the spermathecal ducts unite before opening into the pit, while in the third the ducts open into the pit close together but separately.

The *setal glands* (fig. 1, *s.g.a.*, *s.g.p.*; fig. 2; fig. 3, *s.g.a.*) are two in number, asymmetrically situated; each surrounds a single penial seta, which emerges on the surface through the opening of the gland (fig. 2). The anterior of the two is on the right side in the anterior part of segment vii., and opens in common with the spermatheca, immediately to the right of the right spermathecal duct, as described above. The posterior is further back, either in the hinder part of segment vii. (two specimens) or in the anterior part of segment viii. (one specimen); it is on the left side of the middle line, and terminates a little in front of the left half of the male pore, either in groove 7/8 (fig. 3, *ap.s.g.p.*) or definitely in segment viii. (fig. 1, *s.g.p.*); it has thus, unlike the anterior gland, an independent opening.

Fig. 2.



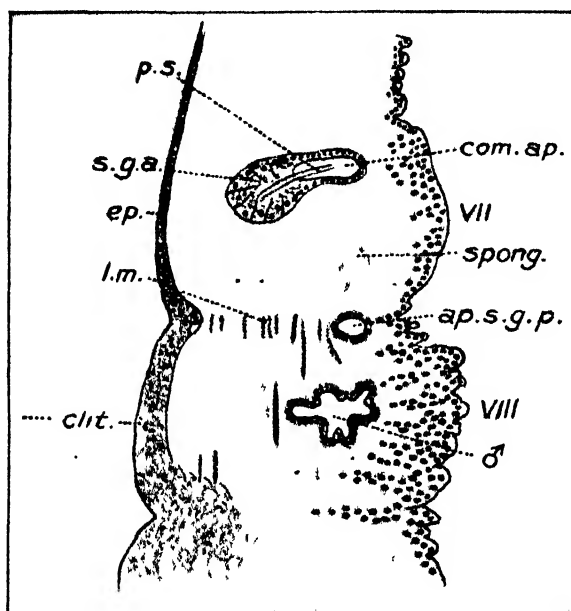
Anterior setal gland in section. The section shows the penial seta in nearly its whole length.

Each gland is somewhat pear-shaped, of a length from fundus to surface (including the narrower neck or duct) of  $115\mu$  and a diameter of  $65-75\mu$ . It is composed of a single layer of cells, with spherical nuclei peripherally situated; the cells are elongated, and are arranged so as to leave a small central cavity  $16\mu$  in diameter in the ectal portion only of the gland. The greater part of the cells consists of loose granular matter; their basal portion, however, appears to be more protoplasmic (*cf.* fig. 2). The gland has a very definite outline, and possesses a partial investment of muscular tissue (shown in the figure) continuous with the muscles attached to the base of the seta (the muscles of the setal sac) behind it.



The *penial setæ* (fig. 4) are in the fully sexual animal two in number, one in association with each setal gland; each penetrates the gland and its cavity in its long axis, reaching

Fig. 3.



An almost horizontal section, near the floor, of segments vii. and viii., seen from the ventral face, showing the several apertures of the genital organs; the combined apertures of the spermathecae and anterior setal gland (with penial seta) are in the anterior part of segment vii., that of the posterior setal gland in groove 7/8, and the combined apertures of the male ducts in segment viii.

The section is at a slightly higher level on the (apparent) left side, where the epithelium has been modified to form the clitellum, than on the right (the epithelium of the mid-ventral region does not become modified).

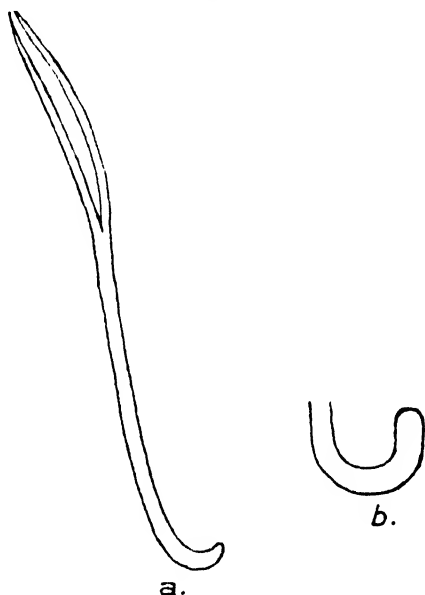
*ap.s.g.p.*, aperture of the posterior setal gland; *clit.*, clitellum; *com.ap.*, common aperture of spermathecae and anterior setal gland; *ep.*, surface-epithelium; *l.m.*, longitudinal muscle-fibres of body-wall; *p.s.*, penial setæ; *s.g.a.*, anterior setal gland; *spong.*, spongy tissue on floor of segments vii. and viii.; ♂, combined male pore.

the level of the surface of the body at its free end, while its proximal extremity projects back behind the fundus of the gland, surrounded by the setal sac within which it has

originated, for a distance of  $40\mu$ . Fig. 2 represents a lucky section which passes through the axis of the anterior setal gland, and actually shows the seta in its entire length; it will be seen that the gland is flattened, or even slightly indented dorso-posteriorly, where the seta in its sac projects backwards beyond the gland. The distal half of the seta lies in the gland-cavity, the proximal in the substance of the gland and behind it.

The penial setæ were observed in fresh specimens by Mr. Aiyer, who found, in less fully mature individuals, two

Fig. 4



Penial seta: *a*, a whole seta,  $\times 640$ ; *b*, proximal end, more strongly curved in this instance.

incompletely formed setæ in each bundle, accompanied in one case by an unmodified ventral seta of the ordinary form

A fully formed seta is  $125\mu$  long and about  $4\mu$  in thickness; the proximal end is curved, like the end of a hockey-stick, according to Aiyer's note, though I find that the curve may be as much as half a circle (fig. 4*b*); the shaft is gently curved, and the distal one-third to two-fifths is taken up by two enormous prongs, which, diverging only slightly,

almost meet again at the tip in the manner of a pair of forceps. Aiyer states that the prongs appear to be joined together by a membrane; in this I agree with him; the distal end of the setæ is cut across in a number of my sections, and in them the two prongs can be seen to be connected by a thin lamella stretching between them. There is no nodulus.

The ventral setal bundles on the left side in segment vii. and on the right side of segment viii. are absent in the specimens which I received.

### *Remarks.*

The genital apparatus of *Naidium breviseta* thus exhibits a number of remarkable features: the very characteristic shape of the penial setæ, and their asymmetry; the large and peculiar glands in association with the penial setæ; the single spermathecal and male apertures; and the large "prostate" glands surrounding the vas deferens.

The above description is also of interest in connection with the question of the relationship of the genus *Naidium* to *Pristina*. That the two genera are closely related is well recognised; they are the only two genera of Naididæ in which seven new segments are added in the budding zone to form the head of the posterior animal (in other genera not more than five are so added); they agree also in the fact that the dorsal setæ begin in segment ii. (though this character is shared by them with a few other forms); they differ, however, in the possession by *Pristina* of a long proboscis (the much elongated prostomium) and the absence of such a feature in *Naidium*.

The two genera are united by Beddard (1895), though Michaelsen (1900) kept them distinct; later, the latter author (1909) also combined them, but Piguet (1906, 1913) retains them as separate. I did the same in my volume on the Indian Oligochæta (1923), hoping that when the genital organs of *Naidium* were discovered the point could be finally settled.

The relationship of the two genera is now again indicated by the presence of the peculiar setal glands in association with the penial setæ, an association which occurs also in the two species of *Pristina* in which the genital organs are known. In other features, however, the differences are more marked than the resemblances; in both *P. leidy*, as described by Smith (1896), and *P. longiseta*, by Piguet (1906), the penial setæ are in segment vi., there is no trace of

prostatic cells, the epithelium of the vas deferens is itself glandular, and the genital apertures are, as usual, paired; here the penial setæ are in segments vii. and viii., prostatic cells are well developed, and the genital apertures are united in the middle line. When one compares these differences with the great uniformity in the genital organs that exists throughout the genus *Nais*, for example, I think we shall conclude that the case for a separation of the genera is strengthened by the above observations.

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XXXVI.—*A new Species of Trematode from Nycticejus pallidus, with a Key to the Species of Lecithodendrium.*  
 By G. D. BHALERAO, M.Sc., Biology Department,  
 University of Rangoon.

ON examination of the intestine of a bat, *Nycticejus pallidus*, dissected by Professor F. J. Meggitt, three Trematodes were obtained. They were pear-shaped, measuring 0.57–0.59 × 0.32–0.34 mm., the maximum breadth being at rather more than two-thirds of the length from the anterior extremity. The cuticle was smooth and transparent enough for the elucidation in the living condition of most of the internal anatomy. The opening of the mouth at the anterior extremity is surrounded by a circular oral sucker measuring 0.09 mm. in diameter. The ventral sucker, 0.05 mm. in diameter, is situated centrally at about one-third the distance from the anterior end: the ratio between the two

suckers being nearly 1:2. Immediately behind the oral sucker is a globular muscular pharynx, 0.03 mm. in diameter. A very small œsophagus is present, but cannot be seen in the mounted specimens. The two short and wide intestinal cæca, measuring  $0.07 \times 0.04$  mm., diverge from the pharynx towards the testes and end much anterior to the latter. The epithelium of these is not thick as in some species of *Lecithodendrium*.

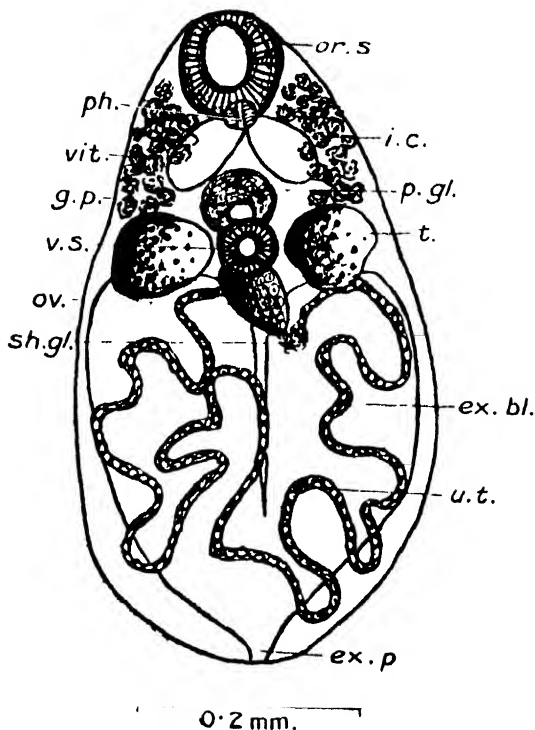
The excretory system can best be studied in the living condition. At the posterior end is an excretory pore leading into a V-shaped excretory bladder. This latter has very wide arms, which approach each other in the central line and occupy more than half the posterior area of the body, overlapping partly the posterior portion of the testes.

The testes,  $0.07-0.08 \times 0.06-0.07$  mm., are from round to ovoid bodies lying symmetrically on either side of the ventral sucker. From their inner border arise two vasa efferentia uniting centrally and dorsal to the ventral sucker to form a vas deferens. This latter enlarges into a vesicula seminalis, which passes into a ductus ejaculatorius after a short curve. The genital pore, through which the ductus ejaculatorius opens to the exterior, is situated immediately anterior to the ventral sucker. A large prostate gland, 0.06 mm. in diameter, partly anterior to and partly overlapping the ventral sucker, surrounds the ductus ejaculatorius.

The ovary,  $0.075 \times 0.05$  mm., is a pear-shaped body lying posterior to and slightly overlapping the ventral sucker. Posteriorly it is continuous with a small oviduct which enters the ootype surrounded by feebly developed shell-glands. Laurer's canal and a receptaculum seminis are present. The uterus arising near the posterior end of the ovary passes to the left, where it first forms a coil, and then passes to the right where it coils again. Ultimately it opens to the exterior by means of the genital pore. All the coils lie posterior to the testes and are disposed antero-posteriorly. The vitellaria with 14-18 follicles on each side are situated laterally in the anterior part of the body; they extend from the posterior half of the oral sucker to the anterior border of the testes, and at places overlap the intestinal cæca. A vitelline duct from each gland extends dorsally to the ventral sucker, and unites with its fellow to form a common duct which enters the ootype. The uterus is filled with yellowish-brown operculated eggs, measuring  $0.022-0.023 \times 0.012-0.014$  mm.

The present form, having vitellaria anterior to the testes, unbranched ovary, and uterine coils disposed longitudinally,

is similar to *L. orospinosa* and *L. longiforme*, previously described (Bhalerao, 1926). From these it differs in having the ovary posterior to the testes, the vitelline follicles extending beyond the ends of the intestinal cæca, and the intestinal cæca thin, short, and ending much anterior



*Lecithodendrium dinanatum.* (Ventral view.)

*ex.bl.* Excretory bladder.  
*ex.p.* Excretory pore.  
*g.p.* Genital pore.  
*i.c.* Intestinal cæcum.  
*or.s.* Oral sucker.  
*p.gl.* Prostate-gland.  
*ph.* Pharynx.

*sh.gl.* Shell-gland.  
*t.* Testis.  
*ut.* Uterus.  
*vit.* Vitellaria.  
*vit.d.* Vitelline duct.  
*v.s.* Ventral sucker.

to the testes ; in addition the former of these has the testes level with the genital pore and a spiny oral sucker, and the latter has its uterine coils unbroken into right and left halves. In view of these differences it becomes necessary

to erect a new species for reception of the present form, for which I propose the name *Lecithodendrium dinanatum*.

*Specific Diagnosis.*—*Lecithodendrium*: Body pear-shaped. Intestinal cæca short, ending much anterior to testes. Excretory bladder with very broad arms meeting in the central line. Testes level with ventral sucker. Ovary entire, posterior to testes. Uterine coils longitudinal, divided into right and left halves. Vitellaria lateral in anterior part of body: follicles extending up to testes. Eggs yellowish brown, operculated,  $0.022-0.023 \times 0.012-0.014$  mm.

The genus *Lecithodendrium* was formed by Looss (1896) to include *Distomum granulosum*, *D. hirsutum*, *D. chefrenianum*, *D. obtusum*, *D. sphaerula*, *D. ascidia*, *D. ascidioides*, and *D. heteroporum*. Subsequently to this, about a dozen more species were proposed and included; Faust (1919), however, in the revision of the genus, recognises only the species *sphaerula*, *ascidia*, *chefrenianum*, *chilostomum*, *cordiforme*, *glandulosum*, *obtusum*, *posticum*, *pyramidum*, *granulosum*, *hirsutum*, and *urna*, others either being excluded or being so inadequately described as to preclude the determination of their exact position. The species above mentioned he divided into three groups: (1) Those with spines on the genital atrium, testes antacetabular, level with genital pore, for which he proposes a new genus *Acanthatrium*, and includes in it the species *A. sphaerula* and *A. nycteridis*. (2) Those with aspinose genital atrium, vitellaria lateral to pharynx, and testes in same plane as the acetabulum, for which he retains the name *Lecithodendrium*, with species *L. ascidia*, *L. chefrenianum*, *L. chilostomum*, *L. cordiforme*, *L. glandulosum*, *L. obtusum*, *L. posticum*, and *L. pyramidum*. (3) Those with aspinose genital atrium, testes level with acetabulum, and vitellaria posterior to cæca, for which he proposes the genus *Mesodendrium*, and includes in it the species *M. granulosum*, *M. hirsutum*, and *M. urna*. This division of the original genus into three is no doubt natural, but requires modification in the case of latter two groups. Faust regards the intestinal cæca as a barrier to the extension of the vitellaria, and accordingly as they pass that limit or not he distinguishes the two genera. It is not a satisfactory classification to place in one genus a specimen with a few follicles of vitellaria extending past the intestinal cæca and to exclude another which only differs from the first in having them rigidly anterior to these organs. The distribution of follicles may serve as a good specific character, but is not of sufficient importance for a generic distinction. The testes are the proper and most natural barrier to the

extension of the vitellaria, and the genera *Lecithodendrium* and *Mesodendrium* should therefore be distinguished from each other according as the vitellaria are anterior or posterior to the testes. Another error has crept into Faust's classification. In *L. ascidia*, van Beneden (1873) describes the vitellaria as being present posterior to the testes, a character which was later utilised by Lühe (1909) for distinguishing the species *L. ascidia* from *L. chilostomum*. Faust, however, includes it in the genus *Lecithodendrium*, thus signifying that the vitellaria are present lateral to the pharynx; it should be removed from the genus *Lecithodendrium* and placed under *Mesodendrium*. Similarly, the species *L. urna* should be removed from the genus *Mesodendrium* and placed under *Lecithodendrium*, the vitellaria being distinctly anterior to the testes. Odhner (1911) proposed a new subgenus *Paralecithodendrium* to include forms with lobed or much branched ovary anterior to ventral sucker.

The following key is given to help the separation of the different species of *Lecithodendrium*.

*Key to the Species of Lecithodendrium.*

- |   |                         |
|---|-------------------------|
| 1. Ovary much lobed .....   | 2.                      |
| Ovary entire .....  | 4.                      |
| 2. Ovary of moderate size .....   | 3.                      |
| Ovary very large, extending from one testis to the other .....                      | <i>L. ovimagnosum.</i>  |
| 3. Prostate gland small, body more than 1.5 mm. long .....                          | <i>L. obtusum.</i>      |
| Prostate gland large, body less than 1.5 mm. long.                                  | <i>L. glandulosum.</i>  |
| 4. Uterine coils horizontal .....   | 7.                      |
| Uterine coils longitudinal .....  | 5.                      |
| 5. Oral sucker without spines, testes level with ventral sucker .....               | 6.                      |
| Oral sucker with spines, testes level with genital pore .....                       | <i>L. orospinosa.</i>   |
| 6. Ovary anterior to testes, vitellaria not extending beyond intestinal caeca ..... | <i>L. longiforme.</i>   |
| Ovary posterior to testes, vitellaria extending beyond intestinal caeca .....       | <i>L. dinanatum.</i>    |
| 7. Caeca end much anterior to testes, excretory bladder V-shaped .....              | 8.                      |
| Caeca reach up to testes, excretory bladder Y-shaped .....                          | 10.                     |
| 8. Vitelline follicles reach up to testes .....                                     | <i>L. urna.</i>         |
| Vitelline follicles anterior to intestinal caeca ...                                | 9.                      |
| 9. Body broader anteriorly, oral sucker the larger .                                | <i>L. chefrenianum.</i> |
| Body fusiform, both suckers equal .....   | <i>L. pyramidum.</i>    |
| 10. Body pyriform .....   | <i>L. codiforme.</i>    |
| Body elliptical or fusiform .....   | 11.                     |
| 11. Suckers almost equal .....  | <i>L. posticum.</i>     |
| Oral sucker very large .....  | <i>L. chilostomum.</i>  |



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XXXVII.—*Note on the Occurrence of a Vole in Northern Africa.* By MARTIN A. C. HINTON.

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ALTHOUGH so widely distributed over Europe, Asia, and North America, no representative of the Microtinæ, living or fossil, was known from the African continent before the beginning of the present year. A study of Pomel's careful description of *Bramus barbarus*, described from the Quaternary Phosphorites of Tunis, shows that fossil to be a species of *Ellobius*, a genus now included in the Microtinæ\*. Just as that conclusion was reached, Mr. Chaworth Musters told me that he was going on a collecting-trip to Cyrenaica, and so I begged him to make a careful search for *Ellobius* and other voles, living or fossil. This Mr. Musters very kindly did. He found no trace of *Ellobius* on the ground, or of its remains in the pellets of carnivorous birds, or in the accumulations of bones found in some of the rock-fissures examined; this negative result was possibly to be expected, Cyrenaica being perhaps too far east to have representatives of the deposits from which Pomel obtained his material. At Merg, in N.W. Cyrenaica, Mr. Musters was, however, fortunate enough to discover a species of *Microtus* living in the cornfields. This vole, of which a fair set of specimens was obtained, proves to be closely allied to *M. philistinus*,

\* Hinton, 'Monograph of Voles and Lemmings,' i. pp. 1 & 87 (1926).

described by Thomas from Palestine. It may be described as

*Microtus mustersi*, sp. n.

A short-tailed, brown-coloured species, closely related to *M. philistinus*.

Size large; hind foot 18 mm.; condylo-basal length of skull probably 30 mm. or more when fully grown. Fur normal, soft and dense, moderately long, attaining a length of 8 mm. on the back in specimens collected in April. General colour of upper parts a rich yellowish brown, the tint darker, warmer, and less greyish than in *M. philistinus*. In some specimens the colour becomes paler on the flanks, to form a narrow indistinct flank-line of ochraceous-buff. Underparts white, darkened considerably by the slaty bases of the hairs. Tail rather inconspicuously bicoloured, brown like the back above, yellowish white below. Ears dusky, rather noticeably contrasted with their surroundings. Hands and feet yellowish white above. Mammæ 2—2=8.

Skull and teeth essentially as in *M. philistinus*, but the choanæ slightly narrower and the auditory bullæ slightly smaller;  $M^3$  slightly less reduced posteriorly, its fourth inner salient angle better developed and a trace of the fourth outer salient angle usually present.

In old age the temporal ridges probably fuse in the inter-orbital region, both in this species and in *M. philistinus*; in the largest skull of *M. mustersi* before me (No. 50, c.-b. l. 27.8 mm.) these ridges are still feebly developed and separated by an interval of 1.9 mm.; in the type and largest skull of *M. philistinus* (c.-b. l. 29.2 mm.) they are more salient and the interval between them has narrowed to 0.5 mm. The material upon which *M. mustersi*, *M. philistinus*, and the nearly related *M. lydius* are based is from a cranio-logical point of view no more than subadult, although the specimens in question are all sexually mature and what is styled in ordinary systematic writing "adult."

Measurements of type (taken in the flesh by the collector):—

Head and body 117 mm.; tail 24; hind foot 18; ear 10.

Skull of type: condylo-basal length 27.8 mm.; zygomatic breadth 16.7; interorbital constriction 3.8; occipital width and depth 13.5 × 7.1; condyle to  $m^3$  and to front of bulla 11.7 and 9.2; nasals 7.8 × 2.9; dental length 16.5; diastema 8; molars (on crowns) 6.1.

Type. Subadult male, B.M. No. 26.8.4.4; original No. 50. *Ann. & Mag. N. Hist.* Ser. 9. Vol. xviii. 21

Collected April 10, 1926, by Mr. J. L. Chaworth Musters and presented by him to the Museum.

*Type-locality.* Merg, Cyrenaica. Altitude 300 metres.

*Remarks.* The differences in colour, skull, and teeth distinguishing this form from *M. philistinus* are apparently slight; but thoroughly adult material, both from Cyrenaica and from Palestine, will in all probability show more important distinctions. Be that as it may, the discovery of a species of *Microtus* in Africa is an event of considerable interest, and Mr. Musters is to be congratulated upon his success.

Mr. Musters contributes the following note upon the habits of this vole and its station:—

“Merg, Cyrenaica, at an altitude of 300 metres and situated in the centre of a basin of inland drainage. The *Microtus* was caught in corn-fields between the town of Merg and the lagoon, where it was very common. In its habits it is more like the rabbit than any of the English voles, living together in large burrows. It comes out to feed about 5 to 6 in the evening and eats apparently corn-stalks which it pulls into its hole. It makes well-marked runs through the corn, and can be caught in traps set openly in these. The two sexes seem to live in different burrows—at least, during the breeding season. It is very easy to trap; the traps are set at the entrance to the burrows unbaited and not covered up. The ground is very hard-baked around.

“The plain of Merg is very fertile, and there is plenty of surface-water during the winter and spring. It is about 20 miles from the coast.”

### XXXVIII.—A new Long-eared Bat from Central Asia.

By OLDFIELD THOMAS.

THE British Museum owes to Mr. P. S. Nazaroff a specimen of a long-eared bat (*Plecotus*) from Kashgar, and this is evidently quite a different species from any hitherto described. It may be called

#### *Plecotus mordax*, sp. n.

Molars very large;  $i^2$  and small premolars minute.

External characters about as in *P. wardi* of Ladak, agreeing with that species in size and the general light colour, though the under surface is hardly so white. Thumbs similarly long.

Skull longer and rather narrower than in *wardi*. Bullæ scarcely so large.

Teeth very different from those of any other species by the great size of the molars and the extreme reduction of the outer upper incisor ( $i^2$ ), the small upper premolar ( $p^1$ ), and the middle lower premolar ( $p_3$ ). Inner upper incisors normal, bicuspid; outer pair very small, their area in cross-section about one-quarter that in other species. Canines large and heavy, the large premolar quite close to them, with little diastema; the little premolar between them quite minute, smaller even than  $i^2$ . Molars very large and heavy, the combined length of  $m^1$  and  $m^2$  3.2 mm., as compared with 2.7 mm. in *wardi*, which is about the normal in the genus, and also broad in proportion.

Below, the incisors are about normal, but the canines and molars are much larger than in other species, and especially they are all very high, the cusp of the canine being 1.8 mm. in height and that of  $m_1$  1.6 mm., measured from the bottom of the valley behind it. As in the upper jaw, the distance between the canine and large premolar is much reduced, and  $p_3$ , the middle premolar, is quite minute, about one-tenth the size of  $p_1$ .

Dimensions of the type:—

Forearm 44 mm.

Head and body 47; tail 48; ear 38; thumb (s. u.), exclusive of metacarpal, 7.5; lower leg and hind foot (c. u.) 31.3.

Skull: greatest length 17.4; basi-sinual length 13.3; mastoid breadth 9; oblique diameter of bullæ 4.7; front of canine to back of  $m^3$  6.4.

*Hab.* Kashgar, Chinese Turkestan.

*Type.* Adult female in alcohol. B.M. no. 26. 8. 1. 1. Collected and presented by Mr. P. S. Nazaroff. One specimen.

This striking species is markedly different from *P. wardi* and all other described species by the extreme reduction of the decadent outer upper incisors and small premolars, upper and lower, combined with the increase in bulk of the canines and molars. These modifications are in the direction of greater biting-power, which is further carried on in such genera as *Scotophilus*, where the teeth which are here diminished have disappeared altogether.

In describing *P. mordax* reference should be made to the *Plecotus* of Tashkend, Russian Turkestan, which Severtzoff\* called *P. leucophæus*, but at the same time synonymized the name with the European *P. brevimanus*. Incidentally, however, he gave two words of description which would validate the name if the animal were identifiable.

\* Ann. & Mag. Nat. Hist. (4) xviii. p. 42 (1876).

But as it is said to be a small form, while its locality is separated from Kashgar by the mighty mountains of the Alai Plateau and the general chain of the Thian-Shan, we may take it as certain that it must be a different species from *P. mordax*.

# XXXIX.—Two new Australian Muridæ.

By OLDFIELD THOMAS.

## A NEW INSULAR RAT FROM WESTERN AUSTRALIA.

To the kindness of Mr. L. Glauert, of the West Australian Museum, Perth, I owe the opportunity of examining a rat from the isolated archipelago of the Abrolhos, out to the west of West Australia, in about lat. 28° S.

It is no doubt related to the mainland species *Rattus fuscipes*, but, as is the case in other instances of such isolation, the teeth are so conspicuously smaller than those of the mainland animal as to indicate specific distinctness.

I would suggest calling it

### *Rattus glauerti*, sp. n.

Size rather less than in *fuscipes*, but the specimen is not very old, the teeth being fully up and in place, but not yet worn. Fur long, coarse, not spinous. Colour, so far as can be judged from a rather discoloured skin, very much as in *fuscipes*, greyish brown above, white below with slaty bases to the hairs. Hands and feet dull whitish. Tail evenly and finely haired, uniformly brown above and below.

Skull even smoother, less ridged, than in *fuscipes*, and rather smaller than in specimens of that species of the same age. Anteorbital notches shallow, owing to the zygomatic plate being but little projected forward. Palatal foramina rather short, scarcely penetrating between the molars, narrow. Bullæ about as in *fuscipes*.

Molars conspicuously smaller than in the allied species, and even smaller, or at least narrower, than in the S. Australian insular rat *R. murrayi*.

Dimensions of the type:—

Head and body (measured on skin) 110 mm.; tail 96; hind foot 25; ear 16.

Skull: greatest length 33; condylo-incisive length 30; breadth across brain-case 15; nasals 11·3; interorbital breadth 4·6; zygomatic plate 3·4; palatal foramina 5·5; bullæ 5·7; upper molar series 5·1; breadth of *m*<sup>1</sup> 1·6.

*Hab.* (of type). East Wallaby Island, Houtman's Abrolhos, Western Australia.

*Type.* Young adult male. B.M. no. 26.7.12.2. Original number 9103. Collected 17th November, 1907, by C. P. Conigrave, and received in exchange from the West Australian Museum.

This insular rat appears to correspond to the mainland *R. fuscipes* exactly as *R. murrayi*, described in 1923\*, does to the S. Australian *R. greyi*, occurring similarly in an island off the coast and being characterized by its greatly reduced molars.

In the present case the animal itself is smaller, but, the type being barely adult, one cannot say whether the island species ever attains the size of true *R. fuscipes*.

In considering the question of these Australian insular rats and their reduced teeth, my attention has been drawn to some specimens from Adele Island, off the coast of N.W. Australia, which by their small teeth seemed to represent another example of the same modification. But further study brings out the fact that the Adele rat is not related to any Australian mainland rat as yet known, but is a member of the *concolor-ephippium* group, found all over the E. Indian archipelago and in the Pacific. It is particularly like members of that group from Amboina. This is an interesting extension of the range of the group and its first known occurrence on Australian soil.

Probably the ancestors of the Adele rats arrived in native canoes—a means of transport that no doubt accounts for the wide insular distribution of the group, of which the Papuan *R. browni* and the New Zealand *R. maorium* are also members.

#### A RAT FROM MORETON ISLAND, S.E. QUEENSLAND.

Mr. Heber Longman, of the Queensland Museum, has been good enough to send me for determination a couple of rats from Moreton Island, collected by Mr. J. E. Young, which I cannot identify with any known species. In honour of its discoverer the animal may be named

#### *Rattus youngi*, sp. n.

General appearance much as in *R. assimilis*, Gould, and with similar semispinous fur, but the colour is paler, more coarsely ticked, and the head, shoulders, and flanks are greyer. Under surface soiled greyish, as in *assimilis*. Ears comparatively short. Hands and feet white. Tail shorter than in *assimilis*, brown above, both hairs and tail rather

\* Ann. & Mag. Nat. Hist. (9) xi. p. 601 (1923).

lighter below, where the scales are brown and the hairs whitish.

Skull smaller and more lightly built than in *assimilis*, its brain-case less broadly developed. Supraorbital ridges well-defined, evenly divergent, without postorbital projections, and carried back across the parietals to the outer corners of the interparietal. Zygomatic plate broad, well projected forwards. Palatal foramina long, narrow, reaching to the first third of  $m^1$ . Choanæ comparatively narrow. Bullæ slightly larger than in *assimilis*, far smaller than in any of the forms of *culmorum*.

Incisors of average size, not specially thickened; somewhat opisthodont, the index  $67^\circ$ . Molars small, narrow.

Dimensions of the type:—

Head and body 165 mm.; tail 135; hind foot 29; ear, on dry skin from crown of head, 13.

Skull: greatest length 38·8; condylo-incisive length 36; zygomatic breadth 20; nasals  $14\cdot5 \times 4\cdot9$ ; interorbital breadth 5; breadth between ridges on brain-case 14; zygomatic plate 4·3; palatilar length 17·3; palatal foramina 8; length of bulla 7; upper molar series 6·4.

*Hab.* Moreton Island, S.E. Queensland, the specimens collected by Mr. Young at Cowan Cowan.

This rat is no doubt related to *R. assimilis*, but may be distinguished by its smaller skull, better-defined supraorbital ridges, and smaller molars. Its skull is lower and less convex upwards than in *R. conatus*, which also has larger bullæ.

At Mr. Longman's suggestion it is named after Mr. Young, who presented the two specimens of it to the Queensland Museum. One of these (B.M. no. 26. 7. 1. 1) has been presented to the British Museum, while the other is no. 4076 of the Brisbane Museum.

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*The Plant-Lice or Aphididæ of Great Britain.* By F. V. THEOBALD. Vol. I. Pp. ix, 372. 1926. Headley Brothers: Invicta Press, Ashford, Kent. Price 25s.

THIS is the first of three volumes of a monograph on the British Aphididæ, a family of Hemipterous insects which, because of the damage its members do to flowers, fruit, crops, roots, vegetables, etc., is of great economic importance, and, on account of certain phases in the life-history, is of considerable interest to the biologist. Such a work has long been needed, for the last one—that of

Buckton—was published nearly half a century ago, and in the intervening period masses of important data have accumulated in scattered scientific journals, and remained buried to the general student. All this information will be found collected and condensed in this work. In the present volume the author deals with the Macrosiphina and Pentalonina, giving full descriptions, copious illustrations of the salient characters used in identification, and details of the life-history of the species where known. The distribution has not been treated as fully as it might have been, but it was unsafe to rely upon many of the records, for in the past it has been the custom to identify species by consulting a host-plant index, a method which, if easy, is anything but reliable. We might cite as an example of the futility of this method of identification the case of Huxley's anatomical studies on the oak aphid; here was one of the finest pieces of research ever done on insect morphology, but, because we do not know for certain which species he was dealing with, and as there are many species of aphids belonging to various subfamilies and differing considerably in structure found on oak, his work has not received the attention which it would otherwise have done had the species been definitely determined. The idea that each plant had its own particular species of aphid has long since been exploded, though it took time, for it was a tedious process this of showing by transterence that a species was capable of living on different host-plants belonging sometimes to widely separate genera or families. Here the species are based upon the only sure foundation—that of morphology. Some may think that Professor Theobald has been rash in the way he has treated certain of the species and in the amount of synonymy he has created. It is possible that in such a family as this, where characters upon which to base the differentiation of species—or, for that matter, of genera—are scanty and often variable, he may have applied the pruning-knife too heavily, and that certain species may have to be resurrected, but it is better, in our opinion, to be able to give an identification by the aid of morphology than none at all where the host-plant is unknown. There may be such a thing as a "biological species," but we do not think that the biologist has yet proved satisfactorily its existence amongst the Aphididæ. Börner certainly has questioned some points both in Davidson's work on the migration of *Aphis rumicis*, where he has, on the strength of his own researches and non-success in transferring this aphid to various plants, erected several new species, and professes to have found morphological support for his action in such a minute character as the relative lengths of the body-hairs, and in Miss Haviland's investigations on *Capitophorus ribis*; but such work as this requires patience, and failure at the first trial need not necessarily imply that the species will not breed on a certain plant. By bringing together a range of food-plants upon which a species, defined by the characters at present in use, lives, Mr. Theobald has provided the biologist with a starting-point for his researches, and it is for the latter to discover, if need be, that the systematist is



dealing with a composite species, and must find other criteria for separation. In the Introduction the external morphology of the family as a whole is dealt with, together with typical life-histories, examples of "parallel series," natural enemies, and a general classification.

*A Handbook of the Birds of Eastern China.* By J. D. D. LA TOUCHE, C.M.Z.S. etc. Part III. Pp. 193-292, pls. viii. & ix. London: Taylor & Francis, 1926. Price 7s. 6d.

In the present portion of his work, which consists of one hundred pages and two plates, Mr. La Touche deals with the families *Pericrocotidæ*, *Artamidæ*, *Dicruridæ*, *Sylviidæ*, *Regulidæ*, *Oriolidæ*, *Eulabetidæ*, and *Sturnidæ*. These families contain eighty-two species and subspecies, of which one only, viz., *Cisticola exilis courtoisi*, is described for the first time. Throughout the work the author shows the same painstaking care as he has in his previous numbers, and continues to keep up to the high standard he set himself when he began. Few ornithological books nowadays, however scientifically correct they may be and however much information they may contain, can be described as interesting. The present work, however, is one of the few. The field-notes are full and well written, and add a great charm to the scientific value of the work. We notice with pleasure the map which accompanies this number, but, as the Tropic of Cancer is misplaced, we understand the publishers are issuing a corrected one with the next Part. The design of the map is simple and is not intended to show much beyond the districts dealt with in Mr. La Touche's work and the principal places to which he refers; but it also makes it easy for the reader to understand how the Avifauna is divided into palæarctic and tropical in Eastern China.

We congratulate Mr. La Touche on an excellent piece of work, and look forward with pleasure to the succeeding numbers.

#### MISCELLANEOUS.

*To the Editors of the 'Annals and Magazine of Natural History.'*

##### *International Code of Zoological Nomenclature.*

DURING this year I have so often been asked how this Code could be obtained that I hasten, with your permission, to announce that the Washington Biological Society has just published a reprint at the price of one dollar. Prof. C. W. Stiles, Secretary to the Commission, says:—"I would suggest that, if your colleagues wish copies, it would expedite matters to order a number at once." The address of the Society is at the Bureau of Entomology, Washington, D.C., U.S.A.

F. A. BATHER.

THE ANNALS  
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XL.—*Some Tertiary Fossil Insects.* By T. D. A.  
COCKERELL, University of Colorado, Boulder, Colorado.

WHEN Dr. Tillyard wrote, some time ago, that he expected before long to publish a book on fossil insects, I answered that I certainly hoped he would do so, as anything he might write on the subject would be of extraordinary value and interest. At the same time it was to be regretted that the book could not contain at least a summary of the knowledge obtainable from the materials accumulated in museums, not to speak of those which might easily be collected. At the present time the recorded facts represent only a part of those materials. At Zürich are hundreds of species obtained by Heer, but left unstudied since his death. The specimens from Baltic amber include a splendid series of Coleoptera, of which a brief summary, without names or descriptions, was given by Reitter. The British Museum contains very many undescribed species, including some extremely interesting things from Gurnet Bay. The Florissant ants, which have been in Dr. Wheeler's hands for twenty years, are still undescribed. I have much material here at the University of Colorado, and know of much more, not mentioned above. The task of setting all these things in order is too great for the present generation, and there is too little active interest.

We can only hope that posterity will eventually do justice to the subject.

For my own part, I can only do what circumstances permit in the midst of other occupations. The descriptions offered below include species which I collected at Sunchal, in the Province of Jujuy, Argentina, in 1925; species obtained on the Kudia River, in Siberia, in 1923; a species found by my wife in the Oligocene (Gurnet Bay beds) of the Isle of Wight; and two beetles of unusual interest collected by Mr. Geo. F. Sternberg at Florissant.

The types of most of the species will be placed in the British Museum.

#### HIPPORHINOPS, gen. nov. (Curculionidæ).

Very large weevils with tuberculate thorax; rostrum moderately stout, nearly as long as pronotum, hardly curved, with a low elevation before the middle on upper surface; antennæ with a long scape directed backward; funicle-joints stout and rounded, short; club large, subpyriform, but pointed; femora moderately stout, hind ones not toothed below; second and third joints of hind tarsi lobed below, the third with the lobe (as seen in lateral profile) claviform and about as long as the diameter of the joint; claw-joint as long as second and third together; elytra (only part of extreme base preserved) with distant rows of closely approximated strong punctures.

Type: *H. sternbergi*, sp. n.

#### *Hipporhinops sternbergi*, sp. n. (Fig. 1.)

Probably black (as preserved dark brown); pronotum densely and coarsely tuberculate, about three tubercles in 1 mm., the tubercles tending to run in irregular transverse rows; head 7 mm. long, of which 5 mm. is rostrum; rostrum in lateral view with apical half about 1 mm. broad and basal half about 1.5 mm., there being a distinct subangular hump on upper side before the middle (the structure which is developed into a large upright horn in *Hipporhinus propinquus*, Marshall); basal part of rostrum above finely tuberculate; antennæ as in *Hipporhinus*, with groove for the long scape; club about 1 mm. long; anterior femora about 5.4 mm. long, the apical part with small well-separated tubercles; hind femora about 5 mm., hind tibiæ about 4, hind tarsi about 3.7 mm. long; coxæ finely tuberculate; sides of thorax tuberculate; rows of punctures on base of elytra about half a millimetre apart, the punctures close-set, about six in 1 mm.

Miocene shales of Florissant, Colorado (*Geo. F. Sternberg*, I. 28).

This is the largest Florissant weevil; if complete it would not be less than 25 mm. long, counting rostrum. The dorsum of thorax before the elytra is 7.5 mm. long; in *Hipporhinus bohemani*, Fhs., this part is 5.6 mm. long, and the whole beetle measures 25 mm. The thoracic tubercles closely resemble those of *H. bohemani*, except that they are considerably smaller and closer together. Although the fragment of the elytron, as preserved, shows rows of punctures,

Fig. 1.



*Hipporhinops sternbergi*, sp. n.

these are perhaps in reverse, and were really rows of tubercles, as in *Hipporhinus capensis* (L.). The relatively slender rostrum at once separates the fossil from *Hipporhinus*; but the resemblance to this Old-World genus is so close that I cannot doubt its significance. At present the species of *Hipporhinus* are well developed in Africa, along with the large and superficially similar species of *Brachycerus*, easily distinguished by the antennæ. Several species of *Hipporhinus* have been recorded from the Oligocene of France and the Miocene of Baden.

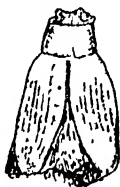
*Buprestis megistarche*, sp. n. (Buprestidæ). (Fig. 2.)

Length from front of head to tip of elytra about 20 mm.; head ordinary, 4.2 mm. wide, practically as wide as anterior margin of prothorax; prothorax (pronotum) ordinary, 4.5 mm. wide in front, 6.2 behind, 4 mm. long, the surface finely rugulose or punctate, without smooth areas; elytra about 14.5 mm. long and 5.5 broad, of the usual shape, with seven finely punctate striæ, the punctures about three in 1 mm.,

these striae extending to the apex, not confluent before; surface between the striae not or hardly punctured.

Miocene shales of Florissant, Colorado (*Geo. F. Sternberg*, I. 17-B).

Fig. 2.



*Buprestis megistache*, sp. n.

This fine species can only be compared with the poorly preserved *B. florissantensis*, Wickham, in which the head is much narrower and differently shaped. Among recent species there is a general resemblance in form and sculpture to *B. confluenta*, Say, living to-day in Colorado.

*Buprestites kudiensis*, sp. n. (Buprestidæ). (Fig. 3.)

Elytron 3.8 mm. long, 1.2 wide; width of insect at middle of elytra 2.4 mm.; elytra broad-shouldered, the basal half parallel-sided, the apical half rapidly tapering to an obtuse apex; dark brown as preserved, without markings; under a lens the appearance is that of a number of fine ridges, converging posteriorly and tending to be coalescent,

Fig. 3.



*Buprestites kudiensis*, sp. n.

the basal region with these ridges distinctly oblique, directed toward the suture; the microscope shows nine grooved striae, the inner two short and running into the sutural margin; the others, not very well preserved, uniting more or less

distally, forming very acute V-like angles. The whole appearance, including the obliquity of the basal striæ and the confluence of the apical ones, so strongly suggests a small Buprestid that I think the reference to this family is assured. The genus is not so certain, so I put it in the blanket-genus *Buprestites*, used for various fossils of this alliance.

Tertiary of Kudia River, Siberia (*Cockerell*, 1923).

There is also a reverse, less perfect. A large pine-seed is preserved on the same piece of rock, less than 10 mm. away. I am indebted to Miss Evelyn Moore for the figures of this and the last species.

*Cryptophagus sunchalensis*, sp. n. (Cryptophagidæ).  
(Fig. 4.)

Length 3.5 mm.; reddish brown without markings; thorax not modified; antennæ not strongly clavate. The following measurements are in microns:—Length of antenna about 1120; width of fifth joint 70; width of last joint 110; diameter of eye-facets 40–50; width of head about 800; width of thorax about 1280.

Fig. 4.



*Cryptophagus sunchalensis*, sp. n.

Sunchal, on same piece of rock as types of *Corizus deflagratus*, Ckll., and *Ormenis devinctus*, Ckll. It is marked D.

This belongs to the section of the genus with ordinary thorax, and resembles *C. petricola*, Wick., and *C. scudderi*, Wick., from the Miocene of Florissant, Colorado. It is distinctly larger than these species. The eye-facets are remarkably large, certainly larger than in a living species compared.

*Anthicus* (s. lat.) *sepultulus*, sp. n. (Anthicidæ).  
(Fig. 5.)

Length 3·4 mm., of which slightly over 2 is elytra ; head rather broad ; eyes small, distinct ; occipital region with a pair of dark marks ; thorax broader than head, but not so broad as the combined elytra, conspicuously broader than long ; elytra of the usual form, dark at base, and with a

Fig. 5.



*Anthicus sepultulus*, sp. n.

broad dark band across the middle, this band sending a sutural extension backward for a distance fully equal to the width of the band.

Sunchal, marked F.

The general appearance is that of *Anthicus*, but the thorax is broad, as in *Hylophilus* and *Corphyra*. It is impossible to refer the insect to any one of the modern segregated genera of Anthicidæ, but there is no sufficient reason for proposing a new generic name. There is certainly no prothoracic horn.

*Curculionites stebingeri*, sp. n. (Curculionidæ).  
(Fig. 6.)

Elytron about 7 mm. long and 3 wide, as preserved pale

Fig. 6.



*Curculionites stebingeri*, sp. n.

coffee-brown, apex subacute ; surface with nine striæ, which, when seen in a certain light, are resolved into rows of very closely set small transverse punctures, nine or ten to a millimetre ; the inner striæ do not reach the apex, there being four altogether with free ending, not uniting with the stria opposite ; of these four the first two are shorter than the others.

Sunchal, marked G.

Named after Mr. Eugene Stebinger, who has done much geological work in this general region, and who aided us materially in our undertaking. This is a well-marked form, but I am unable to refer it to any modern genus known to me.

*Melolonthites interemtus*, sp. n. (Scarabacidæ).  
(Fig. 7.)

Wing about 17·4 mm. long ; cell between media and cubitus (following the system of Forbes, 1922) 7 mm. long, the stem of media very thin, failing basally ; cubitus strong ; first anal of Forbes a scarcely visible shade ; second anal and

Fig. 7.



*Melolonthites interemtus*, sp. n.

thin branches above much as Forbes figures for *Lucanus dama*, but the two thin branches suggest the outline of a bow, the lower the string ; third anal so far as visible simple, bent at base ; membrane between second and third anals fluted.

Tertiary of Kudia River, Siberia (Cockerell, 1923).

This is placed in Heer's blanket-genus *Melolonthites* merely to avoid proposing a new generic name. It may be more exactly placed on comparison with a better series of Scarabacoid wings. There is, however, a general resemblance to the wing of *Melolontha*, though the latter has a closed cell basally between the anals. *Polyphylla* has the first media well developed. Various other Scarabacid wings examined do not show anything which could be congeneric, and it is possible that the genus is extinct.



*Elaterites microstictus*, sp. n. (Elateridæ). (Fig. 8.)

Elytron 5·7 mm. long and 2 broad; as preserved, dark brown, without markings; surface somewhat convex, dull, with nine delicate striæ which really consist of rows of minute punctures, varying from one to two or more puncture-widths apart, and tending to be elongated; there is also a short stria, soon reaching the margin, at the inner basal angle.

Sunchal, at Station 2, marked E. The reverse was also obtained.

The punctured striæ closely resemble those of *Monocrepidius lividus* (De Geer), but the fossil is much smaller and has a well-defined stria between the costal margin and the first punctured stria, and this is bent toward the base of

Fig. 8.

*Elaterites microstictus*, sp. n.

the elytron, thence going to the base at a greater distance from the costa. Nothing like this is visible in the *Monocrepidius*, but in *Corymbites pyrrhos* (Hbst.), which is referred to *Ludius* in the Leng Catalogue, this same line is easily seen, only it departs from the costa basally through the arching of the latter, not from itself being bent. The elytron is, at all events, typically Elaterid.

*Elaterites bruchi*, sp. n. (Fig. 9.)

Elytron elongate, very dark brown, dull, slightly rugose, with ten weak striæ, which are only very obscurely punctured; apex acute. Length 8·5, width 2·5 mm.

Sunchal, Station 2, marked A.

The aspect is that of *Limonius*, but it is impossible to

refer it to a definite genus. It is named after Carlos Bruch, the distinguished Coleopterist of La Plata.

Fig. 9.



*Elaterites bruchi*, sp. n.

*Chrysomelites danielis*, sp. n. (Chrysomelidæ).  
(Fig. 10.)

Elytron moderately elongate, narrow subtruncate, dull dark brown, not very convex, but the rather obtuse apex directed downward; surface practically without sculpture, but two fine parallel striae run close to the outer margin of the apical portion. Length 3, width 1.3 mm.

Sunchal, Station 2, marked B. On same piece of rock as *Elaterites bruchi*, and only 2 mm. from it.

Fig. 10.



*Chrysomelites danielis*, sp. n.

The two submarginal striae resemble those visible in certain Chrysomelidæ. The specific name commemorates our guide, Daniel Rios. The parallel submarginal striae are also to be seen in the fossil *Cerambycites wilmatteæ*, Okll., but the present insect cannot be a Cerambycid, from its small size and general appearance.

*Carabites schueli*, sp. n. (Carabidæ). (Fig. 11.)

Elytron short and broad, obliquely truncate at base, apex obtuse; surface dull coffee-brown, with strongly developed

submarginal channel and at least fifteen extremely weak, closely approximated striæ, marked by small and feeble transverse punctures; the third stria from the inner marginal sulcus appears to be stronger than the others; curved line present after the fashion of *C. cuneatus*, Ckll., but it is much more strongly bent. Length 6, width 3.3 mm.

Sunchal, Station 2, marked C.

Named after Carlos Schuel, the naturalist of Jujuy, who

Fig. 11.



*Carabites schueli*, sp. n.

has interested himself in the collection of fossils. By reason of the numerous striæ and broad form this recalls the peculiar genus *Omophron* (Omophrionidæ), but the feeble punctures are much more numerous and close together and the apex is less acute. Among the true Carabidæ comparison may be made with the Cychrini, but the resemblance is not close. Probably the fossil belongs to an extinct genus, but it would be difficult to define it adequately from the elytron alone.

#### HOMOPTERA.

*Myndus wilmattæ*, sp. n. (Cixiidæ). (Fig. 12.)

Tegmen 5 mm. long and 2 broad, very broadly rounded apically; as preserved very pale, with a creamy tint, the

Fig. 12.



*Myndus wilmattæ*, sp. n.

veins pale brown; no stigmatic spot, or dots on veins, or other markings; radius separating from subcosta distinctly before

middle of tegmen; between radius and subcosta are six cells, the basal large cuneate one and five small ones, three of these having a face on margin; three cells between radius and media, all large; branching of media giving three cells in first series and four marginal, the latter much shorter; three cells between branches of cubitus, the first very much longer than the other two combined. This agrees well with the characters of the living genus *Myndus*; as compared with *M. enotatus*, Van Duzee, the principal difference is in the branching of the cubitus, which is very much nearer the base in the fossil.

Oligocene (Bembridge Beds), east end of Thorness Bay, Isle of Wight (*Wilmatte P. Cockerell*, 1920).

The rock is exactly like that in which the fossils occur at Sunchal, Argentina.

#### HEMIPTERA (HETEROPTERA).

*Pentatomites sibiricus*, sp. n. (Pentatomidæ).

(Fig. 13.)

Scutellum, large, equilateral, the sides 3 mm. long, the apex not produced or rounded, the usual marginal grooves, the surface strongly but sparsely punctured, the punctures irregularly placed; pronotum short and strongly transverse,

Fig. 13.



*Pentatomites sibiricus*, sp. n.

about 4.5 mm. wide and 1.4 long, angulate laterally, the angle nearly a right angle; three longitudinal grooves on disc.

Tertiary of Kudia River, Siberia (*Cockerell*, 1923).

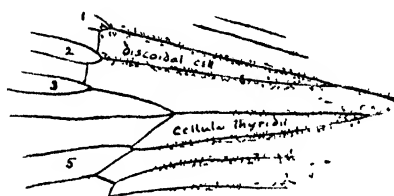
I place this in the blanket-genus *Pentatomites*, but it rather closely resembles *Dinidorites* from the Eocene of Colorado, and *Teleoschistus* from the Miocene of Colorado and the Quesnel beds in British Columbia. There is also a resemblance to *Sepina seychellensis*, Distant, from Mahé in the Seychelles. In the Miocene of Baden there is a rather similar form named *Eurydema brevicollis* by Heer, though it is apparently not a member of that genus.

## TRICHOPTERA.

*Limnephilus kudiensis*, sp. n. (Limnephilidæ).  
(Fig. 14.)

Anterior wing 20 mm. long, 7 wide; not mottled, but conspicuously clouded along the veins as far as about level of end of discoidal cell, and including all the veins bounding

Fig. 14.

*Limnephilus kudiensis*, sp. n.

that cell; discoidal cell very long-cuneate, very slender basally, 7.4 mm. long; cellula thyridis 7.9 mm. long, the apical face very long (about 1.7 mm.) and oblique; forks 1, 2, 3, and 5 present, 4 absent; cross-vein above base of third fork about twice as long as part of first branch of media before fork; cubito-anal cross-vein oblique, its end on anal more basad.

Tertiary of Kudia River, Maritime Province, Siberia (*Cockerell*, 1923).

This is closely allied to *L. recultus*, Ckll., and I hesitated at first to separate it; but it is a longer, proportionately narrower wing, with dark edging to the veins on basal part, and the discoidal cell and cellula thyridis are considerably longer, and the radio-medial cross-vein is nearer the base of third fork.

XLI.—*A new Blind Catfish from Trinidad, with a List of the Blind Cave-fishes.* By J. R. NORMAN.

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IN July 1924 the British Museum (Natural History) received from Mr. F. W. Urich, of the Department of Agriculture, Trinidad, a specimen of a blind catfish from the Guacharo Cave. As this fish had not been previously recognized, I

asked Mr. Urich whether he could obtain further specimens, and he has recently been kind enough to send two more well-preserved examples from the same locality.

*CÆCORHAMDIA*, gen. nov.

Similar to *Rhamdia*, but without eyes.

*Cæcorhamdia urichi*, sp. n. (Fig. 1.)

Depth of body about 5 in the length, length of head  $4\frac{1}{2}$  to  $4\frac{1}{4}$ . Head covered with skin, nearly as broad as long. No trace of eyes externally; the skin above each orbit is invaginated to a varying degree, forming a small pit\*. Jaws equal anteriorly or upper a little projecting; maxillary barbel extending to anterior part or middle of adipose fin; outer mandibular barbel reaching end of pectoral or not quite as far. Occipital process long, narrow, not reaching the basal shield of the dorsal spine. Dorsal I 6-7; spine slender; middle branched rays about  $\frac{3}{4}$  the length of head; free edge of fin convex. Adipose fin commencing a short distance behind the dorsal, separated from base of caudal by a distance which is  $\frac{1}{4}$  to  $1\frac{1}{2}$  in its length; length  $2\frac{1}{2}$  to nearly 3 times in that of fish. Anal 11; low anteriorly, rounded or obtusely pointed posteriorly, the rays gradually increasing in length to the seventh or eighth, which is rather more than  $\frac{1}{2}$  the length of head. Caudal forked; the upper lobe pointed and a little shorter than the rounded lower lobe. Pectoral spine with inner edge serrated in its basal half, about  $\frac{3}{4}$  as long as the fin, which is  $\frac{3}{4}$  to  $\frac{4}{5}$  the length of head. Pelvics extending  $\frac{1}{5}$  or  $\frac{2}{5}$  of the distance from their base to the origin of anal. Uniform pale yellowish brown; an indistinct white band across basal part of dorsal fin.

Two specimens, 125 to 140 mm. in total length, from a pool in the interior of the Guacharo Cave, Trinidad. Mr. Urich informs me that this pool is always in complete darkness; very occasionally, in times of heavy rains, the pool becomes connected with a rivulet running out of the cave.

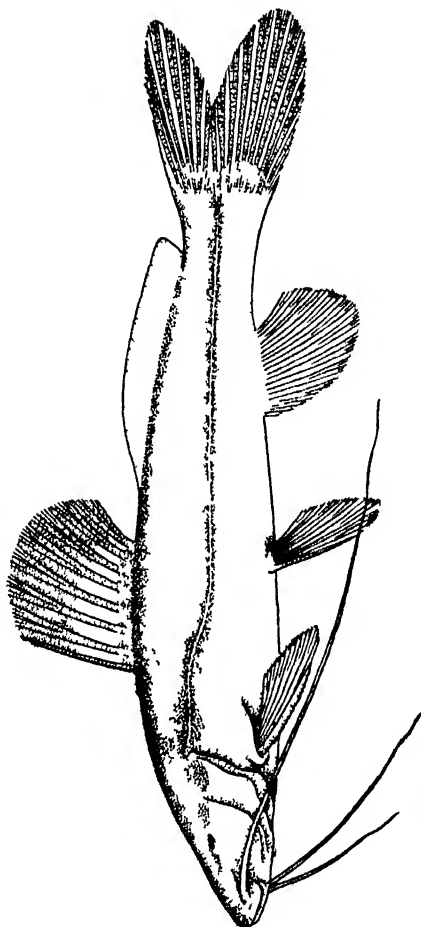
Apart from the absence of eyes, this fish appears to be almost identical with *Rhamdia queleni*, Quoy and Gaimard†

\* The fish has the appearance of having had the eyes gouged out and a part of the original sockets retained. *Typhlobagrus kroniei*, another blind Pimelodine catfish presents a similar appearance (Eigenmann, Mem. Carnegie Mus. vii. 1917, p. 255).

† *Rhamdia wilsoni*, Gill, from Trinidad, may be synonymous with this species.

(fig. 2), a variable species which is widely distributed in eastern South America north of the Rio Plata. When specimens of equal size are compared, however, the mandibular barbels appear to be somewhat longer in the blind fish.

Fig 1

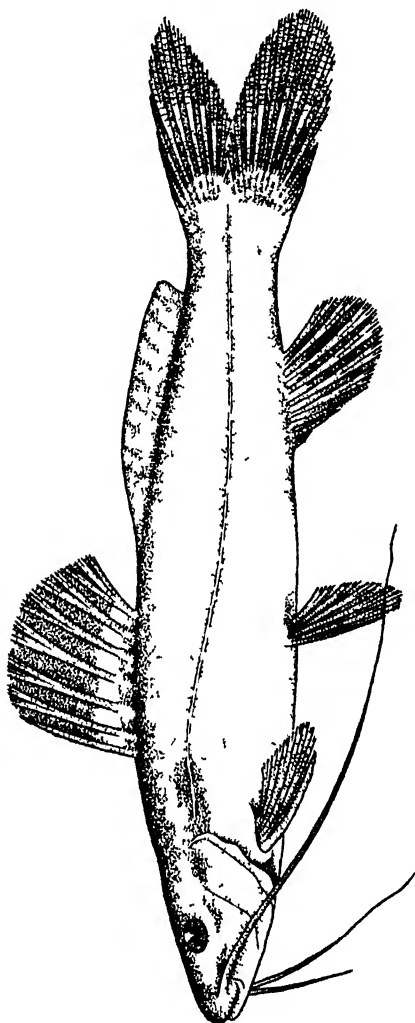
*Caecorhamdia wichu*, sp. n.

W P C Tension del.

In order to draw attention to this interesting fish, and following convention, I have erected a new genus for its reception. I realize, however, that this procedure is somewhat unsatisfactory, for, were the eyes developed, the specimens from the Guacharo Cave would probably be identified with the species *Rhamdia queleni*. Similarly, *Typhlobagrus*

*kronei*, Ribeiro, another blind catfish of the family Pimelodidae, from São Paulo, S.E. Brazil, is said to be distinguishable from *Pimelodella lateristriga*, Muller and Troschel, only

Fig 2



*Rhamdia quelen*, Quoy and Gaimard.

W P C Tenison del

by the absence of eyes; indeed Haseman\* has expressed the opinion that it should be designated *Pimelodella lateristriga*, var. *kronei*.

\* Ann. Carnegie Mus. vii. 1911, p. 323.



Other blind catfishes from North America, belonging to the family Amiuridæ, seem to be sufficiently different from their nearest living relatives to be regarded as distinct species, even if the eyes were present. These are *Gronias nigrilabris*, Cope, and probably also *Trogloglanis pattersoni*, Eigenmann. In both these fishes no trace of the eye-sockets is apparent, but it must be remembered in this connection that the eyes of the Pimelodidæ are normally provided with a free margin, whereas those of the Amiuridæ have no such margin.

The remaining eleven blind fishes included in the list given below would certainly be placed in distinct genera even were the eyes developed. *Cæcobarbus*, for example, differs from *Barbus* not only in the complete absence of eyes, but also in the structure of the scales. In *Phreatichthys*, another blind genus derived from *Barbus*, the scales are entirely wanting.

#### LIST OF BLIND CAVE-FISHES.

##### Order OSTARIOPHYSI.

##### Cyprinidæ.

1. *Cæcobarbus geertsii*, Boulenger, Rev. Zool. Afric. ix. fasc. 3, 1921, p. 252, 1 fig.

*Hab.* Lake in the Grotto of Thysville, Lower Congo ; 700 metres above sea-level.

Related to *Barbus*.

2. *Phreatichthys andruzzii*, Vinciguerra, Ann. Mus. Civ. St. Nat. Genova, li. 1924, p. 239, 2 figs.

*Hab.* "Sorgente termale Bud-Bud a 4° 11', 5 Lat. N. e 46° 30' Long. E. Gr. nella Somalia italiana in territorio Uaesle, presso e confini del Sultanato di Obbia."

Related to *Barbus*.

##### Amiuridæ.

1. *Gronias nigrilabris*, Cope.

*Gronias nigrilabris*, Cope, Proc. Acad. Nat. Sci. Philad. 1864, p. 231 ; Jordan and Gilbert, Bull. U.S. Nat. Mus. xvi. 1882, p. 102.

*Amiurus nigrilabris*, Jordan, Bull. U.S. Nat. Mus. x. 1877, p. 92 ; Jordan and Evermann, Bull. U.S. Nat. Mus. xlvii. 1896, p. 142.

*Hab.* Cave-streams tributary to Conestoga River, Eastern Pennsylvania.

Related to *Amiurus*.

2. *Trogloglanis pattersoni*, Eigenmann, Proc. Amer. Phil. Soc. lviii. 1919, p. 397, 2 figs.

*Hab.* Artesian well, San Antonio, Texas.

Related to *Schilbeodes*.

#### Clariidæ.

1. *Uegitglanis zammaranoi*, Gianferrari, Atti Soc. Ital. Sci. Nat. Milano, lxii. 1923, p. 1, pl. i.

*Hab.* Well at El Uegit, Italian Somaliland.

Related to *Clarias*.

#### Pimelodidæ.

1. *Typhlobagrus kronei*, Ribeiro.

*Typhlobagrus kronei*, Ribeiro, Kosmos, no. 1, Jan. 1907; Fauna Bras., Peixes, iv. (A), 1912, p. 250, pl. xlii. figs. 2, 2 A, 2 B; Eigenmann, Mem. Carnegie Mus. vii. 1917, p. 255, pl. xxxiv. fig. 2.

*Pimelodella lateristriga*, var. *kroneri*, Haseman, Ann. Carnegie Mus. vii. 1911, p. 323.

*Hab.* Cavernas das Areiras, Iporanga, São Paulo, S.E. Brazil.

Related to *Pimelodella*.

2. *Cæcorhamdia urichi*, Norman.

*Hab.* Guacharo Cave, Trinidad.

Allied to *Rhamdia*.

#### Trichomycteridæ.

1. *Phreatobius cisternarum*, Goeldi, C. R. Congrès Intern. Zool. Berne, (1904) 1905, p. 545; Fuhrmann, Arch. Sci. Phys. Nat. Genève, (4) xx. 1905, p. 578; Eigenmann, Mem. Carnegie Mus. vii. 1918, p. 372, pl. lvi. figs. 1, 2, 4, text-fig. 39.

*Hab.* Inland Cistern, Marajo Island, Brazil.

The relationships of this species are uncertain; Eigenmann (Proc. Amer. Phil. Soc. lviii. 1919, p. 398) considers that it may be remotely related to *Heptapterus*, of the family Pimelodidæ.

## Order MICROCYPRINI.

## Amblyopsidæ\*.

1. *Amblyopsis spelæus*, De Kay, Nat. Hist. New York, Fishes, p. 187 (1842); Eigenmann, Cave Vertebrates of America, p. 71, pl. v. (1909).

*Hab.* Subterranean streams of the United States, east of the Mississippi.

2. *Troglichthys rosæ*, Eigenmann.

*Typhlichthys rosæ*, Eigenmann, Proc. Indian. Acad. Sci. (1897) 1898, p. 231.

*Troglichthys rosæ*, Eigenmann, Science, n. s. ix. 1899, p. 280; Cave Vertebrates of America, p. 72, pl. vi. figs. A-C (1909).

*Hab.* Caves and wells in Missouri and Arkansas, U.S.

3. *Typhlichthys subterraneus*, Girard, Proc. Acad. Nat. Sci. Philad. (1859) 1860, p. 63; Eigenmann, Cave Vertebrates of America, p. 73, pl. vi. figs. D-E, text-fig. 28 (1909).

*Hab.* Subterranean streams in caves in Indiana, Kentucky, Tennessee, Missouri, and Alabama, U.S.

4. *Typhlichthys osborni*, Eigenmann, Biol. Bull. viii. 1905, p. 65, figs. 3-4; Cave Vertebrates of America, p. 74, text-fig. 29 (1909).

*Hab.* Horse Cave, Kentucky.

5. *Typhlichthys wyandotte*, Eigenmann, Biol. Bull. viii. 1905, p. 63, figs. 1-2; Cave Vertebrates of America, p. 75 (1909).

*Hab.* Well near Corydon, Indiana.

## Order PERCOMORPHI.

## Suborder BLENNIOIDEA.

## Brotulidæ.

1. *Lucifuga subterraneus*, Poey, Memorias, ii. p. 96 (1856); Jordan and Evermann, Bull. U.S. Nat. Mus. xlvii.

\* For full synonymies of the family Amblyopsidæ see Eigenmann, 'Cave Vertebrates of America' (1909). All the blind forms are allied to *Chologaster*.

1898, p. 2501 ; Eigenmann, *Cave Vertebrates of America*, p. 185, pls. xv., xxv. A, etc. (1909).

*Hab.* Cave-streams in Cuba.

2. *Stygicola dentatus*, Poey.

*Lucifuga dentatus*, Poey, *Memorias*, ii. p. 102 (1856).

*Stygicola dentatus*, Gill, *Proc. Acad. Nat. Sci. Philad.* (1863) 1864, p. 252 ; Jordan and Evermann, *Bull. U.S. Nat. Mus.* xlvii. 1898, p. 2500 ; Eigenmann, *Cave Vertebrates of America*, p. 185, pls. xiii., xiv. (1909).

*Hab.* Cave-streams in Cuba.

XLII.—*Etude Synoptique sur les Espèces de Obereina, Ganglb.*  
(*Coleoptera*, *Cerambycidae*). Par N. N. PLAVILSTSHIKOV  
(Moscou).

Le sous-genre *Obereina*, Ganglb. (du genre *Phytæcia*, Muls.), est bien caractérisé par les élytres fortement séries-punctués (la ponctuation est formée de lignes longitudinales plus ou moins régulières) et par les antennes du ♂ sensiblement épaissies vers l'extrémité. Les plusieurs espèces présentent un dessin élytral très particulier : les élytres plus ou moins clairs (jaunes, plus rarement ferrugineux) avec les bandes longitudinales foncées-suturale et marginales ; ce dessin est très réduit chez *O. pallidipennis*, m., et très développé chez *O. vittipennis*, Reiche.

Les espèces du sous-genre *Obereina* sont répandues dans la région méditerranéenne et sont plus riches dans sa partie orientale. Dans l'Europe nous avons deux représentants de *Obereina*—*vittipennis*, Reiche (les Balkans), et *melanocephala*, F. (Sicile), mais tous deux ne sont pas repandus ici largement : leurs aréals fondamentals sont l'Asie Mineure pour le premier et l'Afrique boréale pour le seconde. Le plus grand nombre des espèces de *Obereina* nous donne le Turkestan où nous avons quatre espèces : *nivea*, Krtz., *ochraceipennis*, Krtz., *texensis*, Sem., et *pallidipennis*, m.

Dans ce sous-genre rentrent sept espèces (avec les décrites ici par moi). Il doit supprimer d'ici *Phytæcia luteovittigera*, Pic, une espèce très douteuse. Je ne sais pas *Ph. luteovittigera*, Pic, en nature, mais d'après la description ('Echange,' no. 253, 1906, p. 4) elle ne peut pas rentrer dans notre sous-genre. Elytres de cette espèce sont décrites comme "tronqués-échancrés au sommet, avec l'angle sutural marque, distinctement punctués, ornés chacun d'une bordure suturale et de

trois bandes discales assez étroites jaunâtres" (de pubescence jaunâtre); prothorax comme "orné d'une large bande médiane et de chaque côté d'une étroite et plus courte bande de poils jaunâtres, à ponctuation moyenne et rapprochée"; aucune des espèces de *Obereina* présente ces caractères (bandes de pubescence jaunâtre sur les élytres, par exemple). D'après la description donnée par M. Pic il est impossible constituer dans quel groupe des Phytœciaires (genre ou sous-genre) rentre cette espèce. Il n'est pas impossible que *Ph. luteovittigera* a été décrite par les exemplaires très petits de *Pteromallosia albolineata*, Hampe, var. *fulvolineata*, Reitt. (sic! N. P.), qui est répandue dans la Perse et Transcaucasie orientale (l'espèce de Pic est décrite comme provenant de la Perse). Une autre espèce décrite par M. Pic du Sikkim (*Ph. sikkimensis*, Pic) semble devoir rentrer, d'après la description, dans ce sous-genre, mais la description est très insuffisante. M. Pic dit que le dessin élytral de sa *Ph. sikkimensis* ressemble beaucoup à *Ph. leuthneri*, Ganglb., mais cette ressemblance peut être très superficielle n'embrassant que le dessin élytral.

Dans le 'Coleopterorum Catalogus,' Pars 74, Cerambycidae: Lamiinae, II., par Chr. Aurivillius, 1923, p. 569, il faut faire quelques remarques dans le sous-genre *Obereina*; de supprimer *Ph. luteovittigera*, Pic, et la placer dans le voisinage de *Pteromallosia* au titre d'une espèce douteuse.

Les ♂ de *Obereina* présentent les antennes plus longues, sensiblement épaissies près du sommet, les élytres plus atténués à l'extrémité, moins parallèles que chez les ♀.

### *Table Synoptique des Espèces.*

- 1 (2). Prothorax en partie rouge; élytres noirs, densément revêtus du duvet gris, leur ponctuation est plus ou moins régulière, mais les points sont disposés en lignes longitudinales seulement par places. Tête ornée de poils couchés.

Noir, prothorax rouge avec les bords antérieur et postérieur noirs, les pattes rouges ou d'un rouge jaunâtre, tarsi noirs, les derniers segments ventraux d'un rouge jaunâtre. Tête large, déprimée ou subsillonée longitudinalement, avec une ligne longitudinale très profonde; assez densément et grossièrement ponctuée. Prothorax irrégulièrement et assez rarement ponctué, avec lisses et imponctués plies sur le disque. Ecuillon densément couvert de poils blancs. Elytres

densément revêtus de duvet gris, densément et fortement ponctués, les points par places rangés en lignes longitudinales. Parfois prothorax noir, une tache subtuberculeuse d'un rouge vif s'étend longitudinalement sur son milieu, et est accompagnée de deux autres bandes de même couleur qui s'étendent dans le même sens sur chacun de ses côtés—var. *lineatocollis*, Levrat (Tunis). Long. 8-11.5 mm. Afrique boréale, Sicile (*rubricollis*, Luc., 1849).....

[1787.  
*melanocephala*, Fbr.,

- 2 (1). Prothorax noir, élytres jaunes ou pâles ou ferrugineux, sans duvet dense, la ponctuation est rangée en lignes longitudinales régulières. Tête et prothorax ornés de poils droits.
- 3 (6). Prothorax sans duvet velouté mais avec bandes longitudinales pubescentes, plus ou moins denses (une médiane et deux latérales).
- 4 (5). Tête et prothorax ornés de poils droits foncés. Elytres avec les poils blancs ou blanchâtres, plus ou moins droits, assez denses, longs et épais dans leur tiers premier, très fortement ponctués (les interstices entre les points sur la base beaucoup plus petits que les points mêmes). Tarses postérieurs un peu plus courts que les tibias postérieurs.

Noir, élytres jaunes ou ochracés ou un peu ferrugineux, la base, le colus huméral, une bordure marginale, l'extrémité et une large bande suturale commune (est réunie antérieurement avec la base noire et entourne l'écusson) noires; la partie apicale des cuisses, les tibias antérieurs, la base des tibias intermédiaires et postérieurs d'un jaune rougeâtre. Prothorax sensiblement plus long que large, profondément mais assez rarement ponctué, avec deux plices brillants; la bande médiane est couverte de poils couchés blanchâtres ou un peu grisâtres; orné de longs poils droits foncés (noirs ou bruns). Elytres très grossièrement ponctués, les points, grands et profonds, rangés longitudinalement; dans le tiers dernier la ponctuation est sensiblement affaiblie; revêtus de poils blanchâtres, fines et pas denses, plus marqués sur les places noires; ornés de poils droits dans tiers basilaire. Dessous du corps revêtu de poils grisâtres. Parfois le dessin noir des élytres est très élargi, les élytres

sont noirs avec une seule petite macule jaune près de la base (var. *leuthneri*, Ganglb.), parfois entièrement noirs (var. *inhumeralis*, Pic), parfois le dessin élytral noir est affaibli, les élytres jaunes avec une ligne marginale et la base noires, la suture jaune, les pattes jaunes avec les bases des cuisses et les tarses noirs (var. *pallidior*, Pic). Long. 8-10 mm. (Balcan, Asie Min., Syrie.)

[1877.  
*vittipennis*, Reiche,

- 5 (4). Tête et prothorax ornés de poils droits blanchâtres, beaucoup plus rares et courts; les poils droits des élytres sont très fines, plus courts et rares; la ponctuation des élytres plus faible, les interstices entre les points sur la base sensiblement plus grands que les points mêmes. Tarses postérieurs beaucoup plus courts que les tibias postérieurs.

Noir, élytres d'un jaune-pâle, une étroite bordure marginale, étroite bande suturale commune, calus huméral et le sommet noirâtres; pattes jaunes, les bases des cuisses, les tibias intermédiaires et postérieurs au sommet et les tarses noirâtres. Prothorax un peu plus long que large, assez dispersément et non profondément ponctué, avec deux lisses plices, pas très élevés et presque imponctués; couvert de poils droits rares, blanchâtres, avec une bande longitudinale médiane et deux bandes marginales plus larges, celles-ci de pubescence blanchâtre pas très dense. Ecusson avec un duvet blanchâtre. Elytres plus courts et larges que chez *vittipennis*, avec les poils couchés blanchâtres également visibles sur toutes les places des élytres; la ponctuation pas profonde et assez fine, dans le tiers premier correspondant à celle du sommet chez *vittipennis*, les interstices entre les points plus larges que les points mêmes, dans le tiers dernier la ponctuation est très affaiblie. Dessous du corps avec les poils grisâtres soyeux, très fins et courts. Long. 7.2 mm. (Transcaucasie: Ordoubad sur l'Arak.)

*pravei*, sp. n.

- 6 (3). Prothorax densément revêtu d'un duvet velouté (les plices exceptés),  
7 (12). Dessous du corps avec un duvet grisâtre ou d'un gris blanchâtre, pas très dense et assez long. Cuisses et tibias pas densément revêtus de poils grisâtres ou blanchâtres. Elytres d'un jaune-pâle ou jaunes ou ochracés.

8 (11). Prothorax avec un duvet d'un jaune de moutarde, la constriction antérieure bien visible. Tête sans dépression transversale.

9 (10). Tibias postérieurs un peu plus longs que les tarses postérieures. Epipleures des élytres, la suture et le sommet sans un duvet blanchâtre plus dense, les épipleures ornés de quelques poils droits blanchâtres dans leur tiers premier. Elytres plus courts, avec les épaules plus arrondies, côté longitudinal au milieu du disque fortement marqué.

Noir, élytres d'un jaune-pâle, sur le calus huméral une petite macule noirâtre, la suture est faiblement et très étroitement obscurcie; les pattes d'un jaune pâle, la base des cuisses, le sommet des tibias postérieurs et les tarses d'un brun rougeâtre clair. Tête ornée de poils droits clairs, densément revêtue d'une pubescence d'un brun jaunâtre; les yeux bordés de poils blancs. Antennes en 1.25 fois plus longues que le corps: prothorax très densément velouté d'un jaune de moutarde, orné de poils droits clairs et nombreuses et deux plices brillants noirs, reflexes en un angle droit. Elytres plus courts et larges que chez *ochraceipennis*, avec les épaules plus arrondies et un côté longitudinal au milieu du disque très marqué; sur la base assez grossièrement mais pas densément ponctués, les interstices entre les points rentrant dans une rangée longitudinale et entre les points des deux rangées voisine sont un peu plus grands que les points mêmes; dans le tiers dernier la ponctuation est très affaiblie, les interstices entre les points en 2-3 fois plus grands que les points mêmes; couverts de poils blanchâtres courts et très rares, sans bandes longitudinales de pubescence plus dense (suturales ou discales), sur le sommet les poils sont plus visibles, mais ils ne sont pas plus denses ici que sur le disque. Dessous du thorax couvert de duvet court d'un gris-bleuâtre, abdomen avec le duvet d'un gris jaunâtre, les sommets de derniers arceaux avec le duvet d'un jaune doré. Pattes avec une pubescence claire, pas dense, d'un blanc grisâtre. Long. 9 mm. (Turkestan: Samarkand.) . . . . .

*pallidipennis*, sp. n.



- 10 (9). Tibias postérieurs sensiblement plus longs que les tarses postérieurs. Epipleures, la suture et l'extrémité des élytres ornés de poils plus denses, les épipleures avec les poils droits nombreuses dans son tiers premier. Elytres plus atténués, avec les épaules peu arrondies, anguleuses; le côté longitudinal du disque faiblement marqué (dans le tiers premier absent ou presque absent).

Noir, élytres d'un jaune pâle ou d'un jaune ochracé, le sommet, une macule humérale, la bande suturale commune et une bordure latérale (toutes les bandes dans deux tiers derniers seulement) noirs, noirâtres ou brunâtres; la bande suturale est plus étroite dans sa partie antérieure n'atteignant pas de l'écusson, plus étroite aussi dans sa partie postérieure et n'atteignant pas de l'extrémité des élytres; pattes noires ou d'un noir-brunâtre ou brunâtres, les sommets des cuisses, les tibias antérieurs et les bases des tibias intermédiaires et postérieurs d'un jaune rougeâtre. Tête revêtue d'un duvet blanchâtre ou jaunâtre, ornée de poils droits clairs. Antennes en 1.15-1.20 plus longs que le corps. Prothorax avec un duvet velouté, très dense, d'un jaune blanchâtre ou d'un jaune de moutarde, orné de plusieurs poils droits clairs; avec deux plices brillants, noirs, plus ou moins arqués en demicercle. Elytres avec la ponctuation grosse, mais pas très profonde dans leur tiers premier et très faiblement ponctué dans leur tiers apical (le duvet assez dense du sommet fait les points presque invisibles ici); ornés de poils blancs ou blanchâtres, très denses sur le sommet, les épipleures et la bordure suturale. Dessous du corps avec un duvet grisâtre, les derniers arceaux de l'abdomen bordés postérieurement de poils cendrés. Pattes avec une pubescence grisâtre, pas dense. Long. 8.5-11 mm. (Turkestan.) . . . . .

*ochraceipennis*, Krtz.

- 11 (8). Tête avec une dépression transversale entre les antennes. Prothorax presque sans constriction antérieure, avec un duvet blanchâtre, un peu jaunâtre, velouté.

Noir, élytres jaunes ou ochracés, avec une macule humérale noire (parfois absente), la bordure marginale et la

bande suturale—comme chez *ochraceipennis*, Krtz.; pattes noires, les sommets des cuisses rougeâtres (ou cuisses entièrement noires), le tiers basal des tibias jaunâtre. Tête brillante, pas très densément ponctuée, avec un duvet assez dense d'un blanc-grisâtre (presque pas jaunâtre), front avec une carène longitudinale. Prothorax avec une ponctuation un peu plus faible que chez *ochraceipennis*, orné de plices plus marquées; avec un duvet d'un blanc grisâtre velouté, sur le sommet un peu jaunâtre. Ecuillon avec une pubescence blanchâtre. Elytres plus atténuées, avec les épaules plus marquées, la ponctuation plus dense que chez *ochraceipennis*; avec une pubescence beaucoup plus rare, d'un blanc-grisâtre, sur l'extrémité jaunâtre, sur le disque, entre les bandes suturale et marginale presque sans pubescence. Dessous du corps avec une pubescence d'un gris blanchâtre très dense. Long. 9.5-11 mm. (Transcaspie.)

*tekensis*, Sem., 1890.

- 12 (7). Dessous du corps très densément revêtu de poils blancs courts, les cuisses et tibias ornés d'une pubescence dense de même couleur. Elytres ferrugineux, ornés de bandes de pubescence blanche (en état frais), une marginale, et une, très large, suturale (couvre le sommet des élytres); avec une ponctuation très forte, les points profonds, subquadrangulaires.

Noir, élytres ferrugineux ou d'un jaune rougeâtre, un peu rembrunis sur la suture et les épipleures dans ses tiers seconde et apical, pattes noirs, la base extrême des cuisses, les tibias antérieurs tous et les intermédiaires et postérieurs moins les sommets rougeâtres. Tête avec une ponctuation profonde mais pas dense, densément revêtu de poils blancs et ornés de poils droits blancs, très courts et fins (en état frais). Prothorax profondément, mais pas densément ponctué, avec deux larges plices brillants, densément revêtu de poils blancs et orné de poils droits fins et courts (les exemplaires frottés présentent prothorax noir avec une pubescence pas dense, presque sans poils droits). Elytres visiblement déprimés sur le disque, avec un côté latéral très

marqué, atténués postérieurement; ponctués très fortement, les points subquadrangulaires, plus grosses dans le tiers basal, les interstices entre les points plus petits que les points mêmes (sur l'extrémité aussi); ornés d'une pubescence de poils blancs assez fins, formant une bande marginale et une très large bande suturale, le reste des élytres avec les poils blancs rares; le disque orné dans sa partie basale de quelques poils blancs, droits, courts et très fins (les exemplaires frottés présentent les élytres entièrement rougeâtres ou ferrugineux avec quelques poils blancs); le sommet densément revêtu de poils blancs. Ecusson avec un duvet blanc. Dessous du corps, les cuisses et tibias densément revêtus de poils blancs, les tarses avec une pubescence blanchâtre. Long. 10-12 mm. (Turkestan.) . . . *nivea*, Kraatz, 1882.

#### NOTICES SUR LES ESPÈCES DU SOUS-GENRE *OBEREINA*, GANGLB.

##### *Phytæcia (Obereina) melanocephala*, Fabr. (1787).

Cette espèce est très distincte par sa pubescence, très dense, des élytres; le prothorax rouge et les élytres densément pubescents donnent lui un aspect de l'*Oberea*. Sa distribution géographique n'est pas très large; elle est connue de l'Afrique boréale: Algérie, Constantine (Pic, 1891), Yakouren (Pic, 1896), Tunisie (Levrat, 1859; Pic, 1897, 1916), et de Sicile (Bertolini, 1904). Il est très possible que *Ph. melanocephala* serait découverte dans l'Espagne méridionale, Portugal et dans les provinces méridionales de France et d'Italie. Var. *lineaticollis*, Levrat, provenant de Tunisie, présente, à ce qu'il paraît, une morphologie de cette espèce (alimentaire).

##### *Phytæcia (Obereina) vittipennis*, Reiche (1877).

Diffère des toutes les espèces du sous-genre par le prothorax orné de bandes longitudinales de pubescence claire (non revêtu entièrement), les élytres courts et atténués du ♂, les poils droits foncés du prothorax et des élytres. *Ph. vittipennis* est une espèce plus variable du sous-genre et présente les déviations (abberations) soit mélaniques (v. *inhumeralis*, Pic) soit avec la réduction du dessin foncé (ab. *pallidior*, Pic). Sa aréal géographique embrasse l'Asie Mineure, la Syrie, et les

Balcans : Balcan (Ganglbauer, 1884), Balcan orient., Grèce, Tokat (Pic 1916), Macédonie, Athos (Schatzmayr! coll. Plav.), Asie Min. (Staudinger! coll. Plav., coll. Mus. Zool. de Moscou), Akbès (Ganglbauer, 1885), Anatolie (Pic, 1901).

*Phytocia (Obereina) pravei*, sp. n.

Nigra; elytris luteo-pallidis, marginis laterali et suturali, apice basisque brunnescentibus, humeris macula parva subnigra ornatis; pedibus testaceis, femoribus mediis et posticis in dimidio basali, tibiis posticis in dimidio apicali et tarsis brunneis; femoribus anticis basi, tibiis anticis et mediis apice brunnescentibus. Capite pilis albidis dense vestito pilisque erectis subalbidis obsito. Prothorace latitudinem suam vix longiore nitido, sat grosse sed non dense punctato, vitta mediana vittaque utrinque laterali dense albedo tomentosus, pilis erectis albidis non longis obsito; utrinque plica lato subfortiter arcuata, nitida, predicto. Elytris pilis albidis sat dense vestitis, seriatim, in dimidio basali grosse, in dimidio apicali multo leviter, punctatis; epipleuris in triente basali pilis albidis erectis vestita. Scutello dense albedo tomentoso. Pedibus non longis, tibiis posticis distincte dilatatis.

Long. corp. 7.2 mm.; lat. in hum. 2 mm.

♂. Antennis elytrorum apicem manifeste superantibus.

♀. Mihi ignota.

Patria:—Transcaucasia: Ordubad ad fl. Araks, vi. (E. Reitter olim leg., 1 specim. in coll. mea).

Ab omnibus congeneribus corpore brevior, tomento elytrorum, prothoracis, abdominis, pectoreque, sculpturam prothoracis elytrisque satis discrepat.

La plus petite espèce, à ce qu'il paraît, du sousgenre. Diffère de sa voisine *Ph. vittipennis*, Reiche, par les poils droits plus courts et clairs de la tête et du prothorax, par la ponctuation plus faible et plus rare de ces organs, par les plices du prothorax presque glabres; prothorax plus court, moins dilaté au milieu; les élytres plus faiblement ponctués (les points moins profonds), revêtus du duvet plus clair et dense; diffère, enfin, par le dessous du corps revêtu d'un duvet beaucoup plus dense et plus long.

Diffère de *Ph. nivea*, Kr., par sa taille beaucoup plus petite, le duvet et la sculpture du prothorax, par la forme, la ponctuation, la coloration et la pubescence des élytres, par le duvet du dessous du corps, etc. De *Ph. ochraceipennis*, Kr., par la ponctuation des élytres et du prothorax, par les poils droits de la tête et du prothorax, par la forme et le duvet de l'écusson, pas la coloration, la ponctuation et la pubescence

des élytres, etc. Diffère de *Ph. tekensis*, Sem., et *Ph. pallidipennis*, m., par les caractères cités pour *Ph. ochraceipennis*, Kr.

J'ai dédié cette intéressante espèce à Monsieur (George) Prave, le fondateur du Musée de Stavropol (au Caucase).

*Phytæcia (Obereina) pallidipennis*, sp. n.

Nigra, elytris luteo-pallidis, humeris macula parva subnigra ornatis, suturam angustissime brunnescentibus; pedibus pallidis, femoribus basi, tibiis posticis apice tarsisque subbrunneo ferrugineis. Capite pilis erectis subalbidis piloso, tomento albido vestito, oculis pilis albidis marginatis. Antennis corporis 1.25 longioribus, singulis articulis infra pilis tenuissimis parce obsitis. Pronoto ad apicem distincte constricto, utrinque ante basin plica sublata rectangulariter arcuata prædito; indumento totius prothoracis fulvo-fusco. Coleopteris brevioribus et latioribus, humeris multo rotundatis, dorso vix nitidis, linea elevata longitudinaliter ornatis, sat grosse, minus dense punctatis, parcius subalbido uniformiter pubescentibus. Indumento abdominis pectorisque griseo.

Long. 9 mm.

Habitat: Samarkand in provincia Turanica (1 specimen in coll. mea).

*Ph. ochraceipennis*, Kr., simillima sed distincte brevior et minus gracilior, elytris uniformiter pubescentibus, brevioribus, linea elevata (cariniformi) longitudinaliter ornatis (multo magis, quam in *ochraceipennis* elevata et ad basin prolongata), sutura, basi, apice epipleurius non densius quam disco pubescentibus, tibiis posticis tarsis posticis parum longioribus. A *Ph. tekensis*, Sem., cui etiam proxima, differt imprimis pronoto aliter tomentoso, multo magis constricto, capite transversim non impresso, elytris aliter pubescentibus (uniformiter) et coloratis, pedibus minus gracilioribus.

Cette espèce est très voisine de *Ph. ochraceipennis*, Krtz.; les différences principales sont données dans la tablelle dichotomique. Elle diffère aussi par son habitus commun, plus court et large, son aspect plus mat, la pubescence des élytres disposée également sur le disque, les épipleures, la suture et le sommet. Diffère de *Ph. tekensis*, Sem., par la structure de la tête, la pubescence du corps, la forme du prothorax, la sculpture des élytres. De *Ph. pravei*, m., et *vittipennis*, Reiche, diffère par la pubescence velouté du prothorax, de *Ph. nivea* par le duvet du dessous du corps, la pubescence du prothorax, la forme, la pubescence et la ponctuation des élytres.

*Phytæcia (Obereina) ochraceipennis*, Kraatz (1882).

Très caractérisé par son duvet velouté du prothorax d'un jaune de moutarde ou, plus rarement, d'un jaune ferrugineux, les élytres d'un jaune pâle avec la bande suturale très marquée, la ponctuation pas très profonde des élytres, la pubescence des élytres plus dense sur les épipleures, la suture et le sommet. Diffère de ses voisines *Ph. pallidipennis*, m., et *tekensis*, Sem., par le côté élytral faiblement marqué, de la première aussi par les tibias postérieurs plus longs, les poils droits des épipleures nombreuses, les élytres plus atténués et moins larges avec les épaules moins arrondies ; de la seconde par la structure de la tête et du prothorax, la pubescence du dessus et dessous du corps plus jaunâtre, la disposition de la pubescence des élytres, par son habitus général moins atténué.

*Ph. ochraceipennis*, Krtz., est répandu dans le Turkestan, principalement dans sa partie centrale et orientale : Samarkand (Kraatz, 1882, coll. mea), monts d'Alaj (Heyden, 1886), Pamir (Pic, 1916), Margelan (coll. mea) ; Buchara : Tshishantan, 1898 (Hauser, in coll. mea).

*Phytæcia (Obereina) tekensis*, Sem. (1896).

Diffère de ses voisines *Ph. pallidipennis*, m., et *ochraceipennis*, Kr., par la tête impréssionnée transversalement entre les antennes, par le prothorax presque sans constriction antérieure, par le duvet plus clair du dessus du corps.

Sa patrie :—province Transcaspienne : les déserts près d'Annau (Séménov, 1896), environs de Poltoratzk (Aschabad olim), 15. v. 1915 (coll. mea).

*Phytæcia (Obereina) nivea*, Kraatz (1882).

Diffère de toutes les espèces du sousgenre par les élytres presque unicolorés, très fortement ponctués, les points subquadrangulaires, la pubescence des élytres très dense, formant les bandes longitudinales, la pubescence blanche du dessous du corps.

La distribution :—Turkestan : Taschkent, 1909 (Lopott, coll. mea, Mus. Zool. Mosq.), 19. v. 1912 (Chainov, coll. mea), Margelan (Kraatz, 1882), Tschinas (Hauser, 1894), Perovsk, v. (Schell, coll. mea). Dans les environs de Perovsk cette espèce est, à ce qu'il paraît, assez commune. Dans le Turkestan *Ph. nivea* est la plus vulgaire représentante du sousgenre *Obereina*.

## XLIII.—Two new Fishes from China.

By ANNA J. VAN DAM.

A COLLECTION of Chinese fishes, presented to the Zoological Museum of Amsterdam by Miss Annita Hüllmann, contains examples of two species new to science :—

*Parasalanx annita*, sp. n.

D. 14; A. 27; P. 10–11. Depth of body 17 in the length, length of head 6. Head nearly 3 times as long as broad; snout not quite so long as postorbital part of head. Diameter of eye nearly 8 in length of head, interorbital width  $5\frac{1}{2}$ ; maxillary ending a little before eye. Teeth on palate in a single series. Some canines in both jaws; lower ending in a movable præsymphysial bone with one series of teeth on each side. Origin of dorsal about  $1\frac{3}{4}$  as distant from end of snout as from base of caudal; origin of ventrals equidistant from præoperculum and origin of anal, which is below third dorsal ray.

A single specimen, 134 mm. in total length, from Peitaiho.

Of the four species described by Regan (Ann. & Mag. Nat. Hist. (8) ii. 1908, p. 446), this appears to be nearest to *P. gracillimus*; but in that species the origin of the ventrals is equidistant from head and origin of anal, which is below the eighth or ninth dorsal ray.

*Hemirhamphus peitaihoensis*, sp. n.

D. 15; A. 14; P. 11 (12); V. 6; Ll. 53–56. Breadth of body  $1\frac{3}{4}$  in its depth, which is  $9\frac{1}{2}$  in length (without caudal). Head without lower jaw  $5\frac{3}{4}$  to  $5\frac{1}{4}$ , entire head  $2\frac{3}{4}$  to  $2\frac{1}{2}$  in length. Interorbital width equal to diameter of eye, about  $1\frac{3}{4}$  in postorbital part of head. Triangular part of upper jaw as broad as long. Teeth tricuspid, in two to three series on the upper jaw; anteriorly in one, posteriorly in two to four series in the lower jaw. Pectorals equal to distance between point of upper jaw and hind margin of eye. Ventrals somewhat less than twice in pectorals, their base midway between caudal and front margin of eye. Dorsal opposite to anal. Caudal broken. Colour yellowish, with a silvery longitudinal band. Fins hyaline.

Two specimens, 170 and 175 mm. in total length, from Peitaiho.

This species differs from *H. gaimardi*, C. V., by its more slender upper jaw, narrower interorbital space, and narrower bands of teeth in the jaws (5–6 series in *H. gaimardi*). Moreover, the individual teeth are larger.

XLIV.—A new *Eurytoma* (*E. arnoldi*, *sp. n.*)—(*Hym., Chalcidoidea*)—from Southern Rhodesia. By JAMES WATERSTON, B.D., D.Sc.

(Published by permission of the Trustees of the British Museum.)

*Eurytoma arnoldi*, *sp. n.*

*Colour*.—Black, including all coxæ, pubescence white. Ovipositor sheath infuscated, hardly paler at tip ventrally. Antenna, scape ferruginous, the rest fusco-ferruginous. Trophi infuscated.

Hind femora blackish brown, the others more ferruginous, darker ventrally. Tibiæ fusco-ferruginous, the fore pair palest, the hindmost darkest (but distinctly paler than the corresponding femora), but neither basally nor apically definitely paler. Tarsi ferruginous. Wings hyaline, nervures pale (not, however, white).

Head broader (6:5) than deep; toruli at three-fifths from vertex to clypeal edge; the latter with a narrow, impressed, median emargination, between which and the toruli there is a narrow median swelling. Eyes about one-third of the depth, separated below the anterior ocellus by two-thirds of the width. Orbital keel strong, weaker on vertex, distinctly crenulate and angulate ventrally. This fork is well below the eye (at nearly three-fourths from the vertex), and from it a strong ridge goes direct to the median clypeal notch. Other hardly weaker ridges render the whole lower face strongly striate with elongate punctures between the striæ. The real oculo-mandibular line (in profile) runs obliquely backwards, and behind it the surface, like that of upper face, vertex, and thoracic notum is strongly umbilicate-punctate.

Clypeus triangular, 6 bristles (3, 3). Antenna length 1 mm., scape (text-fig., *b*) (3:1) rather abruptly narrowed on apical half; just longer than the goblet-shaped pedicel (3:2) together with the ring-joint and first funicular, or a little shorter than the last funicular and the two-jointed club, or about one-third longer than the latter by itself.

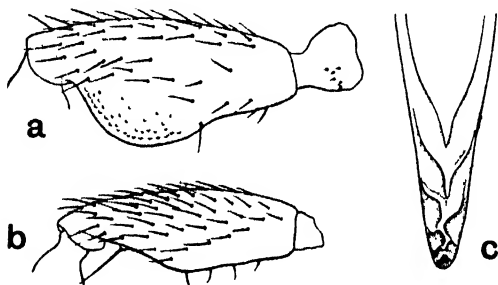
First funicular (3:2) the longest and about one-half to two-thirds longer than any of the others. Second funicular a little (about one-sixth) longer than broad, the rest subquadrate, barely longer than broad. Width of funicle nearly uniformly about one-third that of scape. Club (segments in ratio 9:7) about twice as long as last funicular. Funicle and first joint of club with two rows of bristles and sensoria, second segment of club with only one row. Between the



two rows of bristles on funicular joints 1-2 are a few irregularly set bristles.

*Thorax.*—Scutellum about one-fifth longer than scutum and well produced above the abruptly declivous propodeon. Fore- and mid-coxæ separated by more than the length of the latter. Mesosternal impression of fore coxa extending to about two-thirds, with a strong median tooth.

Propodeon broadly flattened, finely punctate, reticulate medianly, with no indication of a central furrow (though some specimens show traces of a larger looser reticulation and of a faint keel along the mid-line). Just above the insertion of the petiole is a distinct transverse sulcus. The flat mat median area occupies about half the visible breadth of the propodeon from above. Laterally there is the usual extremely coarse strongly raised reticulation of the genus, and the rather narrow spiracle (invisible from above) lies far forward and halfway down the side.



*Eurytoma arnoldi*, sp. n.

Fore wings (20 : 9), all veins slender, marginal and radial veins subequal, the postmarginal a little longer; submarginal; marginal; radial; postmarginal, approximately 27 : 6 : 6 : 7; radius with a definite head three times as wide as the vein and about 8 bristles.

Hind wings (about 7 : 2).

Legs : fore coxæ short, angulate, but not dentate below one-half anteriorly; mid-coxæ simple, without a scale. In the mid- and hind-tarsi the first joint is twice the second.

*Abdomen* (seen from directly above), the postpetiolar tergites 1, 2, and 3 are subequal, 4 equals 2+3, and 5 is longer than 3. In actual length 1 and 4 are about equal. The dorsum as a whole is smooth and shining, as are also tergites 1 and 2 at the sides, 3 not so shining, with faint indications of a pattern, 4 quite dull, reticulate, coriaceous

laterally. Ovipositor tip, one tooth, followed by four L. and three R., and subdivided median boss (text-fig., c).

Length 2.6–2.8 mm.; expanse about 5 mm.

♂.—Colour like ♀, but the antennæ and legs are generally paler, *i. e.*, for the most part ferruginous. Head: scape (text-fig., a) (2:1), globularly swollen on apical half, as long as pedicel (2:1), ring-joint, and first funicular (2:1) together; relative lengths of funicular joints 14:10:10:9:9, and of club 9:9. Chætotaxy as in ♀, but only *one* row of sensoria on each joint. First funicular one-fifth wider than club. Fifth funicular apically straight-edged, the others oblique dorsally.

*Thorax*.—Fore- and mid-coxæ wider apart than in ♀; median sternal prominence less pronounced. Median ridge of propodeon less indistinct.

*Abdomen* compressed, shining, the petiole not extending beyond apex of hind coxæ, and about two-thirds as long.

Length 2.2–2.4 mm.; expanse about 4 mm.

*E. arnoldi*, sp. n., should be easily recognized by the combination of characters seen in the head (shape of scape and sculpture of lower face), mesosternum, and propodeal sculpture. In *E. oleæ*, Silv. (1915), and *E. elongatula*, Silv. (1915), there is a limited area with a similar fine punctate surface on each side of the mid-line, but in the new species the *whole* flattened surface is so sculptured and there is no longitudinal median tovea.

Type, ♀, in British Museum.

One of a series, 3 ♂ (2 imperfect) and 8 ♀ (holotype ♀, allotype ♂, and paratypes). “From web of spider.”

S. Rhodesia, sawmills, 31. xi. 1921 (G. Arnold Coll.).

**XLV.—The Godman-Thomas Expedition to Peru.—IV. On Mammals collected by Mr. R. W. Hendee North of Chachapoyas, Province of Amazonas, North Peru.** By OLDFIELD THOMAS and Miss J. ST. LEGER.

AFTER obtaining the specimens on which No. III. of the present series of papers was based, Mr. Hendee worked northwards of Chachapoyas to Yambrasbamba, and collected the series of which we now give a list.

Most of the species are the same as those recorded in previous lists, but two—a very distinct *Thomasomys* and the interesting spiny rat *Mesomys*—prove to need description as

new. Further and very welcome specimens of the striking *Proechimys hendeei* were also obtained, while even of the known species we think it useful to give an exact record of their localities.

The places where Mr. Hendee worked are all between Chachapoyas and Yambrasbamba, the most important being *Goncha*, 8500', about 15 miles north of Chachapoyas, and *Corosha*, some 10 miles short of Yambrasbamba, all in the Province of Amazonas.

1. *Desmodus rotundus*, Geoff.

- ♂. 449, 455; ♀. 445, 448, 450, 451, 452, 453, 454, 456.  
2 miles north of Corosha, Amazonas, 7000'.  
♂. 476. Yambra, 10 miles north of Corosha, 6500'.

2. *Diphylla ecaudata*, Spix.

- ♂. 443. Corosha, Amazonas, 8000'.

3. *Nectomys apicalis*, Peters.

- ♀. 462. Yambra, 10 miles north of Corosha, 6500'.

4. *Oryzomys keaysi*, All.

- ♂. 490 (juv.); ♀. 487. Yambra, 10 miles north of Corosha, 6500'.

5. *Oryzomys albigularis*, Tomes.

- ♂. 440, 441; ♀. 439. Corosha, Amazonas, 8000'.  
♂. 506, 522; ♀. 507, 521, 523. Goncha, Amazonas, 8500'.

6. *Oryzomys nitidus*, Thos.

- ♂. 472; ♀. 461, 474, 478, 486, 488. Yambrasbamba, Amazonas, 6500'.

7. *Oryzomys minutus*, Tomes.

- ♂. 457, 460; ♀. 458, 459. 2 miles north of Corosha, Amazonas, 7000'.  
♂. 464, 465, 470, 471; ♀. 463, 468, 477. Yambra, 10 miles north of Corosha, 6500'.  
♂. 491, 502, 504; ♀. 492, 494, 495, 503. Corosha, 8000'.

8. *Neacomys spinosus*, Thos.

♂. 483, 484; ♀. 489. Yambrasbamba, Amazonas, 6500'.

9. *Thomasomys rosalia*, sp. n.

♂. 511. Goncha, Amazonas, 8500'. B.M. no. 26. 8. 6. 31. 13th April, 1926. *Type*.

Like *T. aureus*, but much smaller.

Size about three-fourths that of *T. aureus*. Fur similarly thick and woolly; hairs of back about 11 mm. in length. General colour about as in the greyer examples of *aureus*, the head and fore-back deep grey, the hinder back cinnamon. Under surface washed with buffy, paler on the throat, warmer in the inguinal region. Ears brown, with an inconspicuous tawny area surrounding them. Hands and feet silvery greyish brown, the metapodials rather darker. Tail uniformly brown, scarcely lighter below.

Skull shaped very much as in *aureus*, but far smaller. Supraorbital ridges angular and divergent, as in that species, and therefore very different from the condition in *cinereus*, *ischyrus*, and others. Zygomatic plate scarcely projected forward, its edge straight, vertical. Palatal foramina large and open, extending back to the level of the first third of  $m^1$ . Mesopterygoid fossa broadly open anteriorly, contracting behind. Bullæ quite unenlarged, as in *aureus*, very different from the large bullæ of *pyrrhonotus* and *auricularis*.

Teeth as usual, the molars much smaller than those of *aureus*.

Dimensions of the type:—

Head and body 135 mm.; tail 170; hind foot 27·5; ear 20·5.

Skull: greatest length 35; condylo-incisive length 31·2; zygomatic breadth 18·5; nasals  $12·3 \times 4$ ; interorbital breadth 4; breadth of brain-case 14·5; zygomatic plate 3·2; palatal length 15; palatal foramina 7·8; palatal bridge 5·1; upper molar series 6·5.

*Hab.* and *type* as above.

Both externally and in its skull this well-marked and handsome species may be said to be a miniature of *T. aureus*, the difference in size being so great that there can be no question of its specific distinction. Its characteristic ridged supraorbital region readily distinguishes it from *cinereus*, *ischyrus*, and the other medium-sized species with normal bullæ.

"Trapped in wet brush."—R. W. H.

10. *Thomasomys ischyryus*, Osg.

♂. 512, 513, 515, 524, 525, 526, 532, 537; ♀. 508, 509, 514, 527. Goncha, Amazonas, 8000'.

♂. 438; ♀. 442, 444. Corosha, 8000'.

11. *Phyllotis andium*, Thos.

♂. 517, 518; ♀. 533, 540. Goncha, Amazonas, 8500'.

12. *Microxus orophilus*, Osg.

♂. 519, 528, 534, 538; ♀. 510, 516, 520, 529, 530, 531, 535, 539. In alcohol: ♂. 542; ♀. 536, 541. Goncha, Amazonas, 8500'.

13. *Microxus orophilus orientalis*, Osg.

♂. 499, 500; ♀. 496. Corosha, Amazonas, 8000'.

"One of these specimens (no. 499) was caught in the attic of a house. This is the first time that I have found any member of this group occurring in houses."—R. W. H.

14. *Mesomys leniceps*, sp. n.

♂. 481. Yambrasbamba, Amazonas, 6500'.

[♀. 414 (immature). Puca Tambo. 5100'. In previous collection.]

An upland representative of the Amazonian *M. ferrugineus*. Less spinous, especially on the head. Belly ochraceous with white patches.

Size and general character as in *ferrugineus*. Fur less strongly spinous throughout, the spines longer and more liberally mixed with fur; individual spines about 20 mm. in length. Below, the covering is also rather hairy than spinous. Head more hairy than back, scarcely hispid to the touch. Tufts of hairs round ears more profuse. Colour above about as in *ferrugineus*, without the marked contrasted white punctulation of *spicatus*. Below, the general colour is rich ochraceous, about as in *ferrugineus*, much darker than the pale buffy of *spicatus*, but this is modified by large axillary and inguinal white patches, and the interramia is also white. Hands and feet pale buffy, with white digits. Tail very long, freely pencilled terminally, dark brown throughout.

Skull essentially as in *ferrugineus*, but rather smaller and lower, the muzzle rather more slender and the nasals not surpassing the premaxillary processes posteriorly. Malars

and the bones surrounding the anteorbital foramina more slender, the greatest vertical height of the zygoma only 3.6 mm.

Dimensions of the type :—

Head and body 180 mm.; tail 214; hind foot 32; ear 13.

Skull: greatest length 43.5; condylo-incisive length 39; zygomatic breadth 22.8; nasals 13.2; least breadth of muzzle 4.4; interorbital breadth 10.7; breadth of brain-case 17.7; upper tooth-series 7.

*Hab.* as above. Type from Yambrasbamba.

*Type.* Adult male. B.M. no. 26. 8. 6. 61. Original number 481. Collected 26th March, 1926.

When, in the previous paper, a *Mesomys* from Puca Tambo, 5100', was referred to *ferrugineus*, some doubt was expressed as to whether the species really occurred at so high an altitude, and the examination of the fully adult specimen now sent from Yambrasbamba confirms that doubt. We now think that the highland form, with its comparatively long coat, little spinous head, and white-spotted under surface should be distinguished specifically. No doubt, all the forms of this interesting genus are very closely allied, but, allowing for the small series available of each, its three Upper Amazon representatives seem fairly well defined and constant in their respective localities.

"Trapped under roots of tree in heavy forest, at same burrow as *Proechimys hendeei*."—R. W. II.

#### 15. *Proechimys hendeei*, Thos.

♂. 467, 473; ♀. 475, 479, 480, 482, 485. Yambrasbamba, Amazonas, 6500'.

Additional specimens of this striking animal are very welcome.

"Both at Puca Tambo and Yambrasbamba large stones are to be found amongst the trees in many parts of the deep forests, and under these the holes of the *Proechimys* were made. Only one was caught in any other location, and very rarely indeed did I get more than one in a burrow."—R. W. II.

#### 16. *Sylvilagus capsalis*, Thos.

♀. 437. 10 miles north-east of Chachapoyas, Amazonas, 7500'.

♂. 498, 501; ♀. 493, 497. Corosha, 8000'.

XLVI.—*Notes on the Cephalopoda*.—II.

By G. C. ROBSON, M.A.

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A.—ON THE HABITS AND STRUCTURE OF  
*SEPIOLA ATLANTICA*.

In the middle of July of the present year the author's wife obtained a specimen of this species in the *Laminaria*-zone at Bembridge (Isle of Wight) during spring-tides.

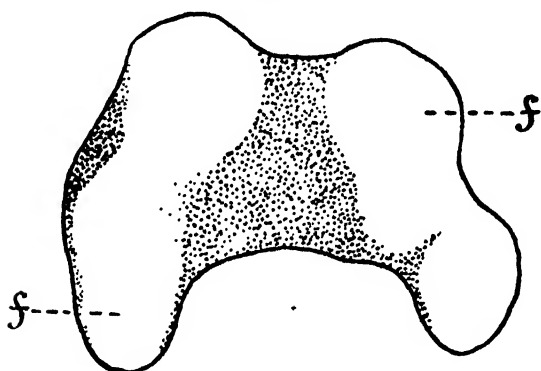
The specimen, which was a female measuring some 20 mm. (mantle) in the mid-dorsal line, was sexually mature. It was kept for some hours in a bucket of water and sand together with specimens of *Leander serratus*. While in captivity it remained nearly the whole time immobile and buried in the sand. It seemed anxious to avoid the prawns, for, if it chanced to be uncovered when the latter came near it, it burrowed into safety with great rapidity. The burrowing seemed to be effected by the fins and funnel as well as by the arms. The current produced by the funnel was obviously an effectual means of clearing away sand, and incidentally I was fortunate enough to confirm the statement—never, as far as I know, recorded in standard works—that the Cephalopod funnel is bent, at least among the Decapoda, to produce a posteriorly directed current as well as the normal anterior one. The animal was apparently anxious to avoid the prawns; but it did not use its "ink" for concealment, though the ink-sac was found full of that fluid after death. Nor did it do so when repeatedly prodded with a stick. During this treatment the colour-changes were marked, the normal pale opalescent colour changing to a deep purplish red. The colour-change thus effected did not render the animal less, but more, conspicuous—at least, to the human eye. The colour, after preservation in ordinary commercial methylated spirit, was well maintained, the most noticeable feature being a strong development of orange-yellow chromatophores on the head and arm. This feature is not recorded by Pfeffer (1908, p. 54).

The *ink-sac*, which has been employed for taxonomic purposes by various authors, is not trilobed, as Russel (1922, p. 24) described it in twenty-six specimens from Scottish and N.E. Atlantic waters. It is transversely expanded, and on each side bears a posteriorly directed horn and a faintly

indicated anterior lobe (fig. 1). Both the posterior and anterior lobes are characterized by their white coloration, and are structurally different from the main part of the ink-sac, being composed of compact fat-like tissue.

The specimen is readily diagnosed as referable to d'Orbigny's species; but there is one particular to be noted in the external features. D'Orbigny figures (1835, pl. iv. figs. 1-2) a form with a saccular mantle, the greatest width of which is about halfway from the apex to the aperture. Pfeffer (1908, p. 54) gives a drawing of a specimen with a conical mantle. Russel (*l. c.* p. 24) says his examples resemble Pfeffer's *rondelarii* in general build, and according

Fig. 1.



*Sepiola atlantica*.  $\times 7$ .

Ink-sac, ventral surface, showing areas of (P) fat (f).

to the figure of the latter (fig. 54) in 'Nordisches Plankton' it is saccular like d'Orbigny's *atlantica*. The mantle of the Bembridge specimen is like that figured by Pfeffer, though it is not so markedly conical.

The species ranges from the surface to a depth of 300 metres (Degner, 1925, p. 77).

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B.—ON A NEW SPECIES OF *SEPIOTEUTHIS* FROM TOBAGO.*Sepioteuthis occidentalis*, sp. n.

One specimen (♂) from Tobago, W. Indies (type), presented to the Zoological Department of the British Museum by P. L. Guppy, Esq.

"The species is common around the island, where it is used as bait" (P. L. G.).

*Dimensions.*

	mm.
Mantle, dorsal length.....	112
"    ventral    "    .....	101
"    width, max. ....	41
"    median    .....	40
"    index    .....	36 (see Wulker, 1913).
Fins, length .....	100
"    breadth .....	25
"    index    .....	26 (see Wulker, 1913).

	R. mm.	L. mm.
Arms: 1st .....	42	44
2nd .....	63	63
3rd .....	73	75
4th .....	70	70

	mm.
Tentacle: total length.....	150
"    length of <i>manus</i> .....	60

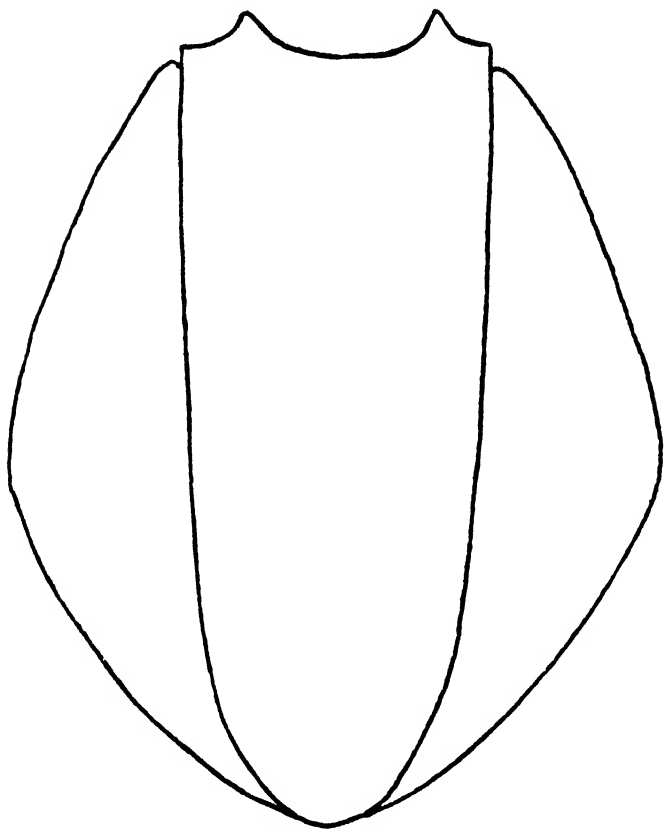
The mantle (fig. 2) is conoid and narrower than that of *S. sepioidea*, while the apex is not broad and square as in that species, nor are the sides so nearly parallel. The pteropods are wide and their point of maximum width lies nearer to the mantle-aperture than in *sepioidea*, viz., at  $\frac{53}{101}$ . It thus recalls the form of *S. ehrhardti*, but the fins are wider and their circumference is not so rounded.

The arms have the formula 3.4.2.1, which differs from that of *S. sepioidea* given by Wulker (*l. c.* p. 464) and d'Orbigny (1835, p. 298). The arms are relatively much longer than those of *S. sepioidea*, being  $\frac{75}{112}$  of the dorsal mantle-length, or about two-thirds of the latter as opposed to two-fifths (Wulker, *l. c.*).

The first arms are laterally compressed. There is a low keel which attains its maximum height at about a third of the way from the base. The lateral membranes are subequal

and weak. The second arms are similarly compressed. The keel and lateral membranes resemble those of the first arms. The third arms are compressed and have a fairly strong keel. The lateral membranes are subequal and

Fig. 2.



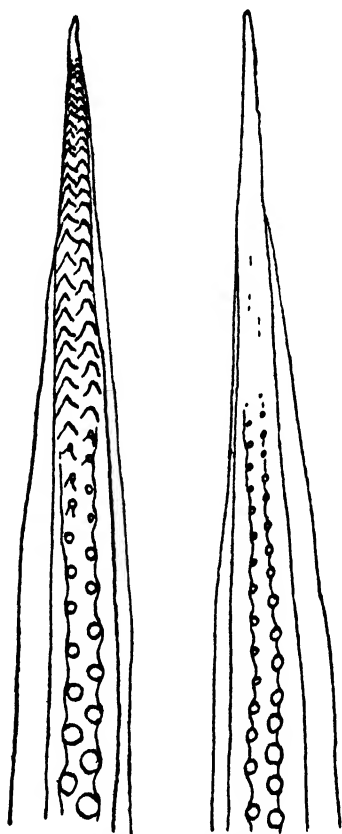
*Sepioteuthis occidentalis*, sp. n. Nat. size.

Outline of fins and mantle.

moderate in width. The fourth arms are subquadrate. The ventral keel is very weak. The dorsal keel is strong and prominent. The lateral membranes are subequal and only moderately developed.

The *hectocotylus* (fig. 3).—The sucker-rings undergo a gradual reduction and are lost on and after the thirty-third to thirty-fourth pair, from which point outwards they are represented only by their pedicels. The dorsal pedicels are triangular, the ventral ones papillose, and there is little

Fig. 3.



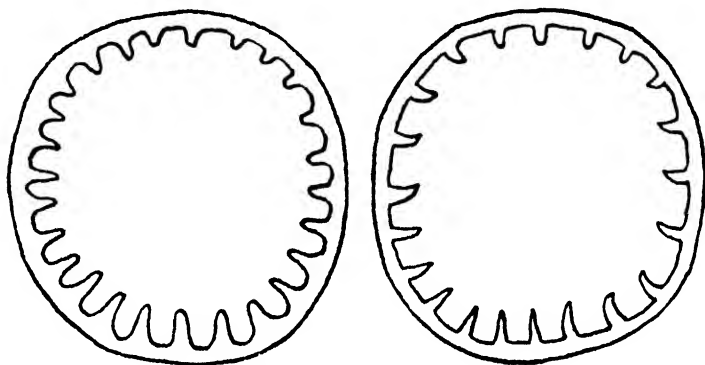
Left and right ventral arms of *Sepioteuthis occidentalis*, sp. n.  $\times 2$ .

difference between them in size, such as is noted by Berry (1912, p. 309) and myself (MS.). A very singular feature of this specimen is that the fourth right arm shows signs of what one may suspect to be hectocotylization. The suckers are gradually reduced in size (rings and pedicels), and after

about the thirty-fifth they disappear, the rest of the arm being smooth. It should be noticed that the suckers disappear *in toto* and are not represented by modified pedicels, as on the opposite arm. That the right arm has undergone a process resembling the hectocotylization of the left is suggested by (1) the modification of the suckers, and (2) the loss of the lateral membranes at approximately the same point in each case. It is, of course, impossible to speak with absolute certainty; but if this observation is verified by means of more material, it will look colourably like a case of bilateral hectocotylization, a condition not otherwise recorded in this genus, but found in *Spirula*, *Idiosepiion*, *Histioteuthis*, and other Decapod genera.

Fig. 4.

Fig. 5.



*Sepioteuthis occidentalis*, sp. n.  $\times 18$ .

Fig. 4.—Sucker-teeth of sessile arm.

Fig. 5.—Sucker-teeth of tentacle.

The *tentacle* has a laterally compressed shaft. The *manus* is very long and narrow, and, as a result of this, the four main sucker-rows alternate very markedly, so that it is difficult to distinguish the regular transverse rows of four suckers. There seem to be two single carpal suckers in a straight line, then a pair, then four rows of three suckers. These are followed by ten rows each of four large suckers, after which there is a fairly marked decrease in size, to some sixteen (the exact number cannot satisfactorily be determined) rows of small suckers, and finally the apex is occupied by the characteristic six or seven rows which diverge to enclose an oblong space first noted by Goodrich (1896, p. 6) and now known to be characteristic of the group (Wülker, *l. c.*, and Robson,

MS.). There are well-developed lateral membranes and a keel, which, as usual, supplies a second lateral expansion towards the apex.

The suckers of the sessile arms (fig. 4) have 25-26 teeth, which are rather conical in shape, but far more slender than the quadrangular teeth of *S. sepioidea* figured by Wülker (l. c. fig. 1 b). The tentacular suckers (fig. 5) have some 21 teeth, which are shorter and more widely spaced than those of *S. sepioidea*. The buccal lappets are devoid of suckers.

This species plainly is related to the group formed by *S. sepioidea*, *S. ehrhardti*, and *S. blainvilleana*, of which the first two are West Indian, the last, Javanese. The most outstanding feature of this group is the lack of suckers on the buccal lappets. From *S. blainvilleana* our species is distinguished by (1) the shape of (a) the mantle and (b) the fins, (2) the number of teeth on the suckers of the sessile arm and tentacles, (3) the relative shortness of the sessile arms of *blainvilleana*. From *S. ehrhardti* it differs in (1) shape and size of (a) mantle and (b) fins, (2) the character of the first arm-pair, (3) the number and character of the sucker-teeth of the sessile arms, (4) the length of the tentacle relatively to the mantle, and (5) of the *manus* relatively to the tentacle-length. From *S. sepioidea* it is distinguished by (1) the shape and size of (a) the mantle and (b) the fins, (2) the length of the sessile arms, (3) the length of the tentacle, (4) the size of the tentacular *manus*, and (5) the character of the teeth of both the tentacular and sessile arms.

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#### XLVII.—*Some new African Lasiocampidæ.*

By W. H. T. TAMs.

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##### *Opisthodontia cardinali*, sp. n.

♀. Antennæ cinnamon-rufous mixed with hazel, sparsely irrorated with warm buff, pectinations honey-yellow; palpi hazel irrorated with warm buff; head and thorax cinnamon-rufous sparsely streaked with warm buff; pectus cinnamon-rufous and warm buff mixed; legs with the femora and

tibiæ cinnamon-rufous, the tarsi inclining to hazel, all irrorated with warm buff; abdomen light buff to warm buff streaked with cinnamon-rufous beneath. Fore wing cinnamon-rufous densely irrorated with warm buff, the veins inclining to orange-rufous and contrasting with the ground-colour, the dorsum at base with some warm buff hair-scales; the fasciæ delicate, of the ground-colour without irroration; an antemedial fascia from the costa at one-fourth from the base, curved (concavity basad) through junction of *Cu* 1 with the cell to just below vein *Cu* 2, recurving and merging into vein *A* 2 at about two-thirds from base; a small spot at middle of discocellulars; a subterminal fascia sharply oblique terminad from costa at two-thirds to vein *R* 5, which it meets halfway between junction of veins *R* 5 and *M* 1 and the termen, then serrate (with points on the veins) to tornus; fringe edged with hazel. Hind wing coloured like fore wing, but with the dorsum broadly coloured like the abdomen; a small spot at middle of discocellulars; a deeply curved (concavity basad) postmedial fascia from near apex to middle of vein *Cu* 2, forming almost a semicircle. Underside of both fore and hind wings warm buff, with cinnamon-rufous to hazel irroration in distal half, costa cinnamon-rufous, fringe hazel.

Expanse 54 mm. (47 mm. from tip to tip).

Holotype ♀: Gold Coast, Northern Territories, Kete Krachi, 1926 (*A. W. Cardinall*).

*Chrysopsyche jefferyi*, sp. n.

♂. Antennæ with the shaft olive-brown, pectinations on proximal half honey-yellow, on distal half black-brown; palpi and head ochraceous-buff to ochraceous-tawny; thorax olive-brown with long ochraceous-tawny hair-scales; pectus in front ochraceous-buff, olive-brown behind; legs olive-brown with tibiæ and tarsi streaked with ochraceous-buff; abdomen olive-brown with a xanthine-orange anal tuft. Fore wing russet, lightly suffused with Hay's russet, strongly near the base, with the costa and dorsum edged with olive-brown; in the cell, from base to discocellulars, a xanthine-orange streak, another from base to termen between veins *Cu* 2 and *A* 2; a fine fuscous-black to black antemedial fascia arising from costa at right-angles, curved in middle of cell and running into dorsum at right-angles; a slight discocellular streak of Hay's russet; a fuscous-black postmedial fascia oblique from costa to junction of veins *R* 4 and *R* 5, thence straight to dorsum almost parallel with the antemedial fascia; faint traces of fuscous subterminal shading below apex;

fringe olive-brown. Hind wing with area above cell to termen Hay's russet, beyond the cell from vein *Rs* to vein *Cu* 2 auburn with traces of russet, in and below the cell and below vein *Cu* 2 to dorsum olive-brown with traces of Hay's russet near the termen; termen and base of fringe olive-brown, the fringe edged with light buff. Underside of fore wing olive-brown, with a slate-violet sheen in the proximal third; traces of the two xanthine-orange streaks, with a patch of xanthine-orange scaling beyond the end of the cell halfway to the termen and extending from vein *M* 1 to vein *Cu* 2; underside of hind wing olive-brown with a slate-violet sheen above the cell and traces of xanthine-orange scaling in and around the end of the cell, the scaling of the wing apparently thinner in the distal half.

Expanse 44 mm. (38 mm. from tip to tip).

♀. Antennæ with the shaft ochraceous-orange, the pectinations honey-yellow; palpi, head, thorax, pectus, and legs ochraceous-orange; abdomen xanthine-orange above, xanthine-orange mixed with ochraceous-orange beneath. Fore wing old-gold, the costa and terminal fringe xanthine-orange, as well as the dorsal fringe from base to antemedial fascia; the base of the cell as far as the antemedial fascia more or less with a patch of fuscous to fuscous-black irroration interspersed with a few English red scales; a strong antemedial fascia, English red, arising from the costa almost at right-angles, curved in the middle of the cell and then running straight to the dorsum which it meets almost at right-angles; an English red streak from the antemedial fascia to the postmedial fascia, lying between vein *R* 1 and the cell, and a spot of the same colour at the middle of the discocellulars; an English red postmedial fascia sharply oblique from the costa terminad, angled just proximal to the junction of veins *R* 4 and *R* 5, and running to the dorsum, slightly bowed (concavity terminad) and meeting the dorsum almost at right-angles; between the fasciæ sparse fuscous to fuscous-black irroration, extending beyond the postmedial fascia to the subterminal fascia, which consists of three ill-defined xanthine-orange (inclining to English red) spots between veins *R* 4 and *M* 2, irrorated with fuscous to fuscous-black, the irroration extending to the tornus; the whole area between the postmedial fascia and the termen, from vein *M* 1 to the tornus, irrorated with xanthine-orange. Hind wing xanthine-orange, fringe old-gold edged with warm buff. Underside of both wings xanthine-orange, costally, terminally, and dorsally edged with ochraceous-orange inclining to old-gold, the hind wing with some long ochraceous-

orange hair-scales from base of costa, and an indistinct short English red fascia from middle of costa to vein *Rs*.

Expanse 57 mm. (52 mm. from tip to tip).

Holotype ♂ and allotype ♀: Kenya Colony, Kitale, 10. vi. 1924 (*G. W. Jeffery*).

*Odontocheilopteryx pattersoni*, sp. n.

♂. Antennæ warm buff, pectinations honey-yellow; palpi, head, thorax, pectus, legs, and underside of abdomen warm buff tinged with buff-yellow and streaked with ochraceous-tawny, chestnut, and Hay's russet shading to Hessian brown; the upper surface of the abdomen without the darker streaks, the Hessian brown most pronounced on the tegulæ. Wings thinly scaled and opalescent; fore wing with a mottled appearance, caused by the scattered distribution of fine fuscous-black, chestnut, warm buff, and Hessian brown scales, the veins sparsely streaked with rich velvety chestnut scales; an indistinct fuscous-black antemedial fascia roundly curved (concavity basad) through the middle of the cell to base of vein *Cu* 1, then waved to inner margin; a small tuft of cartridge-buff scales forming a light spot at middle of discocellulars; a festooned subterminal fascia more or less parallel with the termen, the concave aspects of the festoons terminad, the festoons meeting one another in interneural black points, the latter accentuated terminad by warm buff spots; fringe alternately chestnut and buff-yellow, the latter at the vein-ends. Hind wing buff-yellow suffused with chestnut, particularly below the cell and towards the termen, the fringe chequered as in the fore wing. Underside of both fore and hind wings faintly buff-yellow, weakly suffused with russet.

Expanse 34 mm. (31 mm. from tip to tip).

Holotype ♂: Gold Coast, Aburi, 1912-1913 (*W. H. Patterson*).

*Odontogama nigricans milleri*, subsp. n.

♀. Smaller than and lacking the rich coloration of *O. nigricans nigricans*, Aurivillius, the tones ranging from benzo-brown or walnut-brown to vandyke-brown, the base of the hind wing and the underside of both fore and hind wings being drab, the underside fringes fuscous. Pattern similar to that of the typical subspecies.

Expanse 62 mm. (58 mm. from tip to tip).

Holotype ♀ and paratype ♀: Tanganyika Territory,



Bukoba, 21. xi. 1921 and 10. ix. 1921 respectively (*N. C. E. Müller*).

Fig. 1.



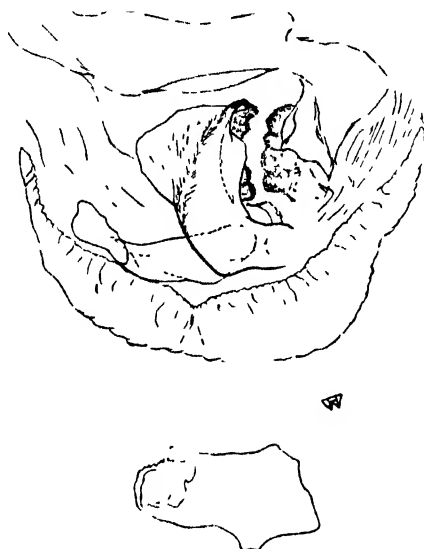
Fig. 2.



External genital armature : Cavity of the genital sclerite large, and containing a large trilobate antevaginal process,

the median lobe of which is strongly chitinised and curved over the vaginal orifice. Fig. 1 shows the plan of the genital cavity in *Odontogama nigricans nigricans*, fig. 2 a diagonal view with one lateral process dissected out and shown below

Fig. 3.



to display its outline, fig. 3 a similar view of *O. nigricans milleri*.

(Colours from 'Color Standards and Color Nomenclature,' by R. Ridgway, Washington, D.C., 1912.)

XLVIII.—On a new Species of the Nematode Genus  
*Thubunæa*. By H. A. BAYLIS, M.A., D.Sc.

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MR. H. W. PARKER, in examining some lizards from Peru recently acquired by the British Museum (Natural History), found in the mouth and oesophagus of several of them a number of specimens of a Nematode worm, which he kindly handed to the writer. The lizards in question belonged to two species, of different families, viz., *Tropidurus occipitalis* (Peters) (Iguanidæ) and *Dicrodon calliscelis*, Cope (Teiidæ). They were spirit-specimens, and the proper habitat of the

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worms is doubtless the stomach. The worms proved to be all of one species, which is referred, provisionally at least, to the genus *Thubunæa*, Seurat, 1914. The specimens from *Tropidurus occipitalis* will be taken as typical for the purpose of the following description:—

*Thubunæa parkeri*, sp. n.

Length of male up to 10.5 mm.; length of female 14.5–18 mm.; maximum thickness, male 0.3–0.34 mm., female 0.4–0.44 mm. The body increases in thickness posteriorly, its maximum diameter occurring in the posterior third. Lips paired, lateral, rounded, relatively small, each bearing on its inner surface three blunt, forwardly-directed teeth. Cephalic papillæ not made out. Cuticle of body somewhat inflated in the cervical region, without lateral alæ. Transverse striations

Fig. 1.

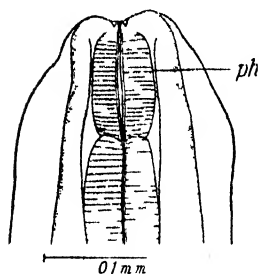
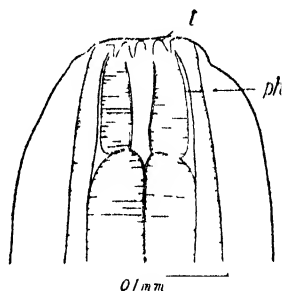


Fig. 2.



*Thubunæa parkeri*, sp. n.

Fig. 1.—Anterior end of female; dorsal view. *ph*, pharynx.

Fig. 2.—Ditto; lateral view. *ph*, pharynx. The teeth (*t*) of one lip are shown by transparency.

of cuticle very fine (about  $2\ \mu$  apart). Œsophagus preceded by a short, laterally compressed pharynx, and divided into a narrower anterior portion and a wider, granular, posterior portion. Distance from anterior extremity to end of pharynx 0.05–0.08 mm.; to end of anterior division of Œsophagus 0.22–0.38 mm.; to end of entire Œsophagus 1.1–1.75 mm. Cervical papillæ prominent, situated at 0.23–0.3 mm. from anterior end. Nerve-ring at 0.19–0.24 mm., and excretory pore at 0.3–0.35 mm. from anterior end.

Caudal end of male usually slightly curved towards the dorsal side, with much-inflated cuticle rather than definite lateral alæ, thickly covered ventrally with numerous irregularly-rounded papilliform elevations, irregularly arranged and

of varying size. Tail about 0.25 mm. long. Sublateral caudal papillæ pedunculate, apparently eight to ten on each side, of which five are preanal. There are usually fewer postanal papillæ on the right than on the left side. It is probable that other papillæ exist, in addition to those mentioned, but the ornamentation of the cuticle renders them very difficult to detect. Spicules and accessory piece apparently absent (see, however, further remarks below).

In the female the body begins to taper posteriorly in front of the anus, and the tail itself tapers very rapidly, forming a cone. It is 0.16–0.2 mm. long. There is a pair of caudal papillæ, situated at 0.05 mm. from the extremity. The vulva is situated at 3–3.5 mm. from the anterior end of the body. The short, muscular vagina runs posteriorly from it, and the uterus, at a distance of about 1 mm. from the vulva, gives origin to two wide, parallel, posteriorly directed branches. The eggs are very numerous, roundish-oval, have extremely thick shells, and contain embryos when ready for laying. They measure 0.0575–0.0625 mm.  $\times$  0.0475–0.0525 mm.

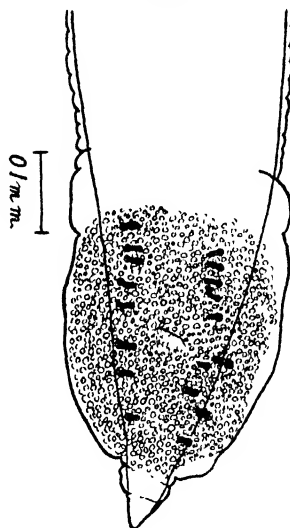
#### DISCUSSION.

The genus *Thubunæa* appears to be closely related to *Physaloptera*, and has been placed in the subfamily Physalopterinae of the family Spiruridae (see Baylis and Daubney, 1926, p. 223). The only species known hitherto is the genotype—*T. pudica*, Seurat, 1914,—which occurs in the stomach of various reptiles in North Africa. The present species so closely resembles *T. pudica* that its generic separation from *Thubunæa* seems scarcely justifiable. Seurat (1914), in his description of *T. pudica*, says:—"Les spicules, sensiblement égaux (150  $\mu$ ), ne sont pas chitinisés et, de ce fait, ne peuvent être vus qu'à la suite d'un examen très attentif." The writer has examined the five males of *T. parkeri* at his disposal very closely, without discovering anything that could be definitely described as spicules. In one or two specimens there appeared to be faint indications of some paired structure in the neighbourhood of the cloaca which might possibly be the rudiment of a pair of unchitinized spicules, but nothing more definite can be said at present on this point.

Seurat describes, in the male of *T. pudica*, in addition to the pedunculate sublateral caudal papillæ, a group of twelve sessile ventral papillæ near the cloaca. He says, however, that the "granulations" on the ventral surface "rendent les papilles peu discernables." This is very much the case in *T. parkeri*, where it has proved an almost impossible task to

determine how many of the cuticular tubercles are actually the terminations of sessile papillæ. In all probability some of them are, but no attempt has been made to differentiate between them in the accompanying figure (fig. 3).

Fig. 3.



*Thubunæa purkeri*, sp. n.

Caudal end of male; ventral view.

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 SEURAT, L.-G. 1914. "Sur un nouveau Nématode parasite des Reptiles." Compt. Rend. Soc. Biol. Paris, lxxvi. pp. 724-727.

#### XLIX.—Two new Species of Veliidæ from the S.E. Pacific. By L. EVELYN CHEESMAN, F.E.S., F.Z.S.

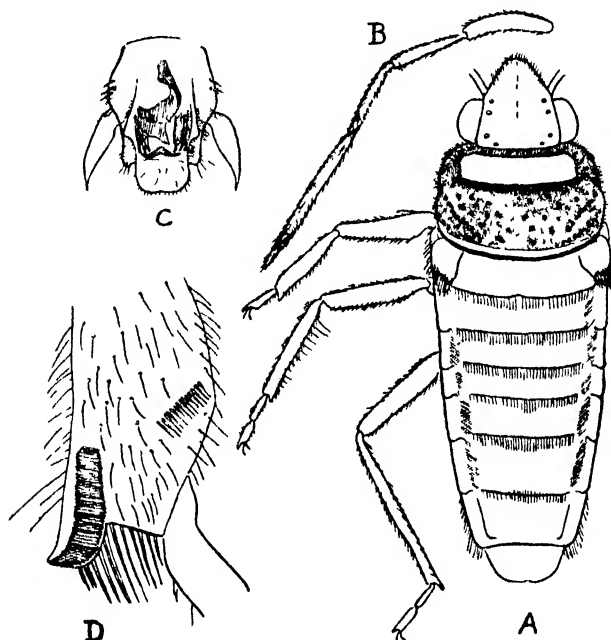
##### *Microvelia prompta*, sp. n. (Fig. 1.)

Apterous ♂ narrowly obovate, clothed with short fusco-testaceous pile. Head fusco-testaceous, with median carina fuscous, and with silvery-brown hairs next to inner margin of the eyes; underside fulvous. Rostrum fuscous. Antennæ with short fuscous pubescence intermixed with longer light brown hairs. Pronotum with dense velvety pubescence; a

broad subanterior fascia not reaching anterior angles, and the basal border fulvous. Sternum with dense shining light brown pubescence. Abdomen above with long silvery hairs fringing the apical margins of the abdominal segments and the sutures of the connexiva; below clothed with short grey velvety pubescence. Legs fusco-testaceous, coxæ and base and underside of femora fulvous.

Head from above wider than long, sparsely punctate; four

Fig. 1.



A. *Microvelia prompta*, ♂, sp. n.

B. Antenna.

C. Genitalia, ♂.

D. Tibial comb.

pairs of sense-organs approaching inner margins of eyes (see fig. 1, A), each organ consisting of a very minute, black, cup-shaped depression with one hair arising from the centre. Rostrum reaching second coxæ. Antennæ long and slender; first segment reaching beyond apex of head, second segment one-fifth shorter than the length of first, third segment slender, almost as long as first, fourth rather more than twice the

length of third. Pronotum sparsely and deeply punctate; disc strongly arched, broadly rounded at the sides, deep transverse furrow at the basal margin of the fulvous fascia. Anterior tibiæ twice as long as tarsi, with short tibial comb at apex (see fig. 1, D), intermediate tibiæ more slender, once and one-fifth the length of anterior tibiæ, furnished with long slender spines on inner side diminishing in length towards apex, tarsi rather more than half the length of tibiæ; posterior tibiæ two and two-thirds the length of tarsi. Anterior tarsi coequal in length with second joints of intermediate and posterior tarsi. I agree with Carlini (Ann. Mus. Gen. xxxv. p. 120, 1895) that the anterior tarsi of *Microvelia* are 1-jointed, and not 2-jointed as described by recent authors, the apparent joint at the base of the tarsus being merely a fold of chitin and not a true articulation. Similarly, the intermediate and posterior tarsi are only 2-jointed.

♀ apterous, colour as in ♂. Pronotum more sparsely and irregularly punctate. Abdomen broader towards apex than in the ♂. Connexiva reflexed, bent inwards over dorsum of abdomen, meeting at apex of fifth segment.

Length 2 mm., width .7 mm.

Thirteen ♂, five ♀, thirteen immature. B.M. Coll.

Tahiti, Society Islands, 1925 (L. E. Cheesman). Very numerous in pools, streams, and backwaters of rivers, from sea-level to 1500 ft.; usually consorted with *Gerris lineata*, Carpenter.

Allied to *M. oceanica*, Dist., and *M. macgregori*, Kirk., but differs from both in coloration and in relative lengths of segments of antennæ and of legs.

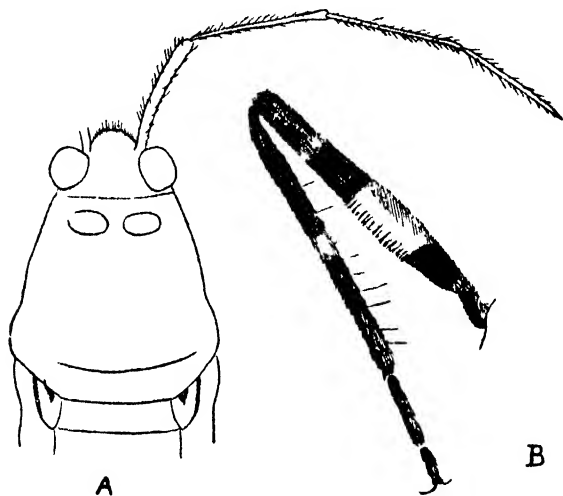
*Velia taipiensis*, sp. n. (Fig. 2.)

Apterous ♀ elongate, densely clothed with short velvety fusco-ferruginous pile intermixed with shining brown hairs. Underside of head fuscous; rostrum fulvous, darker at the base. Pubescence of transverse furrow on pronotum, patches on connexival segments, fascia on fifth abdominal segment, and entire sixth and seventh segments with the exception of a triangular patch on margin, silvery-white. Pronotum with two whitish, oval, bare, opaque fascia subanteriorly; abbreviated wings white, with centre and outer margin almost to apex fuscous. Legs fusco-testaceous, annulated with fuscous; intermediate and posterior femora with broad anula on basal half silvery white, narrow anula centre of tibiæ and of first tarsal joint creamy-white. Ventral surface densely clothed

with fusco-ferruginous pile in which the brown hairs predominate.

Head from above wider than long, with indistinct median carina. Eyes rather large and prominent, coarsely faceted. Rostrum reaching just beyond first coxæ. Antennæ, first segment as long as breadth of head from above, second and third segments slender, coequal, once and one-eighth the length of first, fourth segment five-sixths the length of third. Pronotum as broad as long, coarsely and sparsely punctate; disc arched for a quarter its length, with transverse furrow at its base before the wide basal margin. Anterior tarsi as long

Fig 2

A. *Velia taylori*, sp. n.

B. Intermediate leg.

as first segment of intermediate and posterior tarsi.

Apterous ♂ rather narrower abdominal segments, anterior tibiae with a row of short blunt teeth extending the length of the inner side.

Length 4.6 mm., width 1.5 mm.

Three ♀, one ♂ (damaged). B.M. Coll.

Taipi Valley, Nuka-hiva, Marquesas Islands, 1925 (L. E. Cheesman, St. George Exp.). In backwaters of the river.

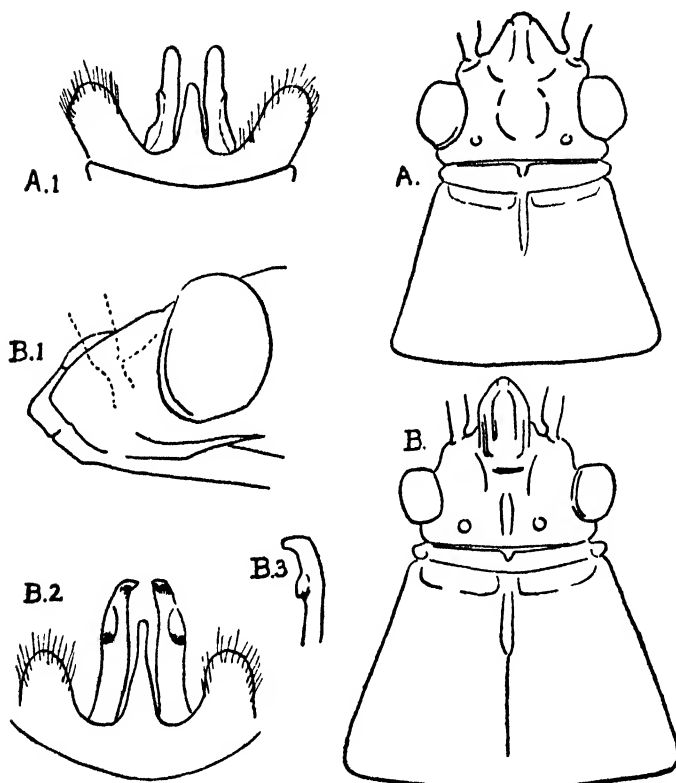
My thanks are due to Mr. W. E. China for his very kind assistance.



L.—Two new Species of Coreidæ from the South-east Pacific. By L. EVELYN CHEESMAN, F.E.S., F.Z.S.

*Leptocoris marquesensis*, sp. n. (Fig. B.)

♂. Deep red; ocelli bright red; the tylus, vertex, pronotal calli, basal two-thirds of pronotal disc, hemelytra (except



- A. *Leptocoris taïtensis*, sp. n.  
 A.1. Ditto, ♂ genitalia.  
 B. *Leptocoris marquesensis*, sp. n.  
 B.1. Ditto, tylus.  
 B.2. Ditto, ♂ genitalia.  
 B.3. Ditto, paramere.

basal half of costal margin) suffused with black and showing a dark purplish colour. Antennæ, rostrum, legs (except the red coxæ and trochanters), and hemelytral membrane black.

Venter with the second to fifth segments obscurely suffused with black.

Head seen from above shorter than width below the eyes; tylus arched higher than juga; vertex strongly sculptured, sharply separated from the tylus and juga, with a median furrow strongly defined near the base; eyes large and very prominent. Seen from the side, height four-fifths of length. Rostrum reaches just beyond the middle of the third abdominal segment. Antennæ long and slender, with short sparse pilosity, first segment exceeding the head by about one-third its own length, second and third segments coequal, fourth segment length equals from basal margin of pronotum to base of antennæ, about one-eighth longer than third segment. Pronotum more than two-sevenths longer than wide, disc densely but finely rugosely punctate, calli transverse, median carina wider and more distinct between the calli, sides straight, narrowly reflexed, basal border narrow. Pronotal collar with anterior margin lightly reflexed and sides tuberculate; disc slightly rounded at the base. Hemelytra densely and finely punctate, exceeding the abdomen by one-fifth their length.

♂ genitalia figured, parameres with lateral tubercles.

Length 12 mm., width  $3\frac{1}{2}$  mm.

Three males, Fatu-hiva, Marquesas Islands (St. George Exp.). B.M. Coll. In low herbage, sea-level, 6. i. 25.

Resembles *L. isolata* in general form of male genitalia, but differs in more strongly sculptured head and in raised tylus.

*Leptocoris taitensis*, sp. n. (Fig. A.)

♂. Yellowish-red, pronotum (except the calli), apex of scutellum, and hemelytra suffused with brown; covered with short, golden, flat-lying hairs intermixed on head and pronotum with coarse black hairs. Antennæ black, except the basal segment ferruginous-red, moderately pilose with golden-brown intermixed with black hairs.

Rostrum black, ferruginous at the base. Underside yellowish-red, five basal ventrites suffused with fuscous irregularly, and with the apical margins of third, fourth, and fifth more or less distinctly fuscous; pleuræ with central fasciæ fuscous. Legs black, except coxæ ochraceous-red; acetabula fuscous with light yellowish margins. Hemelytral membrane infuscated with brown.

Head with indistinct median furrow; width below the eyes slightly exceeding the length. Vertex raised between

the eyes, sharply separated from the clypeus, which is produced in front; tylus slightly higher than juga; eyes large and prominent. Rostrum reaching almost to apical margin of third abdominal segment. Antennæ long and slender; first segment exceeding the apex of the head by about one-third its length, second segment a trifle longer than third, fourth segment one-fourth longer than third. Length of pronotum two-thirds of the width; disc finely punctate, slightly arched at the base, sloping gradually towards pronotal collar which is twice as wide in the centre as at the sides. Median carina distinct for half its length. Calli transverse. Hemelytra finely punctate, exceeding the abdomen by one-sixth their length.

♂ genitalia figured, parameres not tuberculate.

Length 11 mm., width 3 mm.

Five males, five females, one immature, N. Tahiti, Society Islands, 6. iii. 25 (*L. E. Cheesman*). B.M. Coll. Taken among grass and low herbage.

Resembles *L. lurida*, but differs in longer rostrum, length of head, width of pronotal collar, and in male genitalia.

LI.—*Hyænodon aimi*, *sp. n.*, and a Note on the Occurrence of *Anthracotheium minus* from the Headon Beds at Hordle.

By C. FORSTER COOPER, M.A., Superintendent of the University Museum of Zoology, Cambridge.

CREODONTS from the British Isles are very rare, both in the quantity of specimens and in the number of species represented. Of the thirteen European species\* that have so far been described, the British Museum Catalogue records only two, *Hyænodon minor* and *Pterodon dasyuroides*. In the

\* These are:—

*Hyænodon leptorhynchus*, de Laiz.

— *heberti*, Filh.

— *dubius*, Filh.

— *compressus*, Filh.

— *cayluxi*, Filh.

— *aymardi*, Filh.

— *vulpinus*, Gerv.

— *sequieni*, Gerv.

— *brachyrhynchus*, de Blainv.

— *gervaisi*, Martin.

— *nilloquensis*, Martin.

— *ambiguus*, Martin.

— *Alholi*, Schloss.

Sedgwick Museum at Cambridge there are some fragmentary specimens of *H. minor*, and these seem to be all that have been collected. All the specimens were found in the Headon Beds either of the Isle of Wight or in the corresponding deposits at Hordle on the mainland opposite. A further specimen of some interest has been discovered this year at Hordle by Mr. W. Lennie Aim, to whom I am indebted for the opportunity of its examination. It is an almost complete lower jaw, typically Hyænodont in character, but differing in certain details from *H. minor*, the only other British species of the genus. In an endeavour to come to a conclusion as to whether this specimen should be considered as a new form or as no more than a small form of *H. minor*, it has been compared closely with the other known British specimens which have kindly been lent to me by Dr. Bather and Professor Marr, in whose respective charges they are. As the series is far too small to afford any range of comparative measurements, I applied for help to Dr. W. J. Sinclair, of the University of Princeton, where there is a larger collection of various species of American Hyænodonts. Dr. Sinclair very readily sent a list of measurements, showing the difference in sizes of different species and the range of size within specific limits. To all these gentlemen, as to Mr. Aim \*, the discoverer of the specimen, my thanks are due.

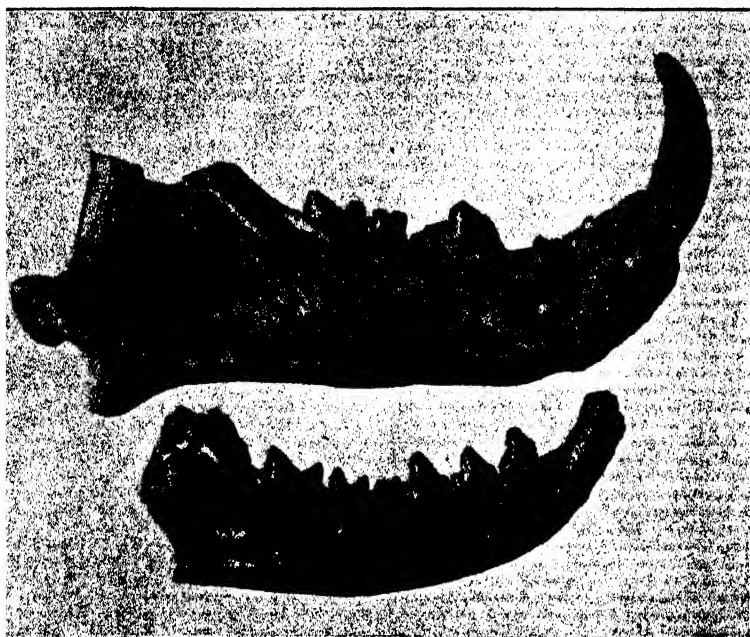
*Hyænodon aimi*, sp. n.

The type-specimen is a lower jaw, of which both rami are preserved from the front as far back as part of the ascending ramus behind the third molar. The teeth, with the exception of the incisors and first premolars, are all present in good condition and are only moderately worn. They are in a completely closed series, and there are no diastemata. The incisors have not been preserved, but were evidently very minute, and, from the general appearance and small area of the border between the canines, it is likely that there were only two pairs present. The first premolars, which are represented by the sockets, lay close up against the posterior border of the canines, a point of difference from *H. minor*, where there is a distinct, if not very large, space between these teeth †. The crowns of the premolars are more upright,

\* Mr. Aim has generously allowed the specimen to be added to the National Collection at South Kensington.

† In both of the only two specimens of *H. minor* available for comparison there is an anomaly in that the first premolar is missing on one side. The British Museum specimen [M. 29752] lacks that on the right, the Cambridge specimen that on the left.

otherwise the general shape of the teeth is closely similar in the two forms. The lower border of the ramus is more curved in the form under discussion than in *H. minor*, where it is rather more flat. In measurement the tooth-series is in length only a little less than that of *H. minor*, but other measurements involving the general size of the jaw show a



A. *Hyænodon minor*, from a specimen in the Sedgwick Museum.

B. *Hyænodon aimi*, sp. n.

About three-quarters the natural size.

much greater discrepancy, the present mandible being considerably smaller and more slender.

The measurements, in millimetres, are as follows:—

	<i>H. aimi</i> .	<i>H. minor</i> (B.M.).	<i>H. minor</i> (Cambridge).
Length from anterior border of socket of <i>pm</i> <sub>1</sub> to <i>m</i> <sub>3</sub> .....	69	71·5	75
Depth of ramus under <i>m</i> <sub>3</sub> ....	20	30	35

In discussing whether this jaw is to be considered as belonging merely to a small form, perhaps a female, of

*H. minor*, or whether it represents a new species, we have to rely a good deal on evidence from other sources as to the range of variation both sexual and specific. Dr. Sinclair\*, with reference to the American species, states that "there are marked differences in size between species and species, but not much variation in size within specific limits," and his measurements bear out his statement. The difference in depth of this jaw and that of *H. minor* is as much as 35 %, which is more than can be found as a sexual difference in modern Carnivores. On this ground, coupled with the small differences mentioned above, we may conclude that the present form is specifically distinct from *H. minor*. From the continental forms of approximately equal size it differs in some respect or other. From *H. compressus*† and *H. vulpinus*, for instance, the large diastemata in these two species are sufficient to distinguish the present form. All the others are of considerably larger size. We may consider therefore that the jaws here described belonged to a small new species of *Hyænodon*.

## REFERENCES.

- FILHOL. 'Mammifères de Ronzon.' 1881.  
 ——. 'Phosphorites du Quercy.' 1876.  
 MARTIN. "Revision der Creodonten Europas." Revue Suisse de Zoologie, xiv. 1906.  
 SINCLAIR. "Concretionary Zones of the *Orcodon* Beds." Proc. Am. Philos. Soc. lxiii. 1924, p. 103.

*Note on the Occurrence of Anthracotherium minus at Hordle.*

In a recent account in this Journal‡ I called attention to the fact that the specimens in the collections of the British Museum hitherto labelled *Anthracotherium minus* did not belong to that species, but to *Brachyodus percinus*, and stated that, in consequence, *A. minus* was not known to occur in the beds. Lately a specimen has been found in the British Museum (M. 29736, apparently not mentioned in the Catalogue) consisting of a lower first and second molar undoubtedly belonging to *A. minus*. This species therefore definitely occurs in these beds, as was to be expected.

\* In a personal letter, from which he kindly allows me to quote.


† As figured by Martin, pl. xviii. figs. 6 & 7.

‡ Ann. & Mag. Nat. Hist. (9) xvii. p. 337.

LII.—*A new Species of Cicadatra (Homoptera, Cicadidæ) from Waziristan, with Notes on the Allied Genus Psalmodarias, Kirk.* By W. E. CHINA.

(Published by permission of the Trustees of the British Museum.)

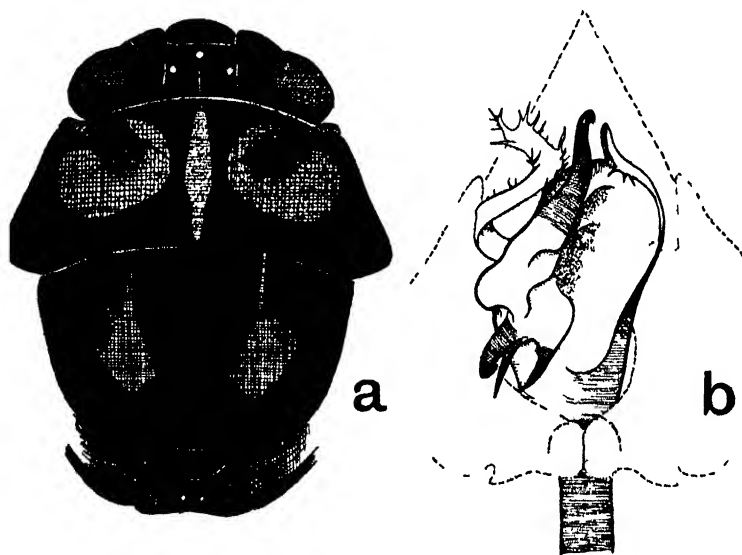
*Cicadatra gingat* \*, sp. n.

♂ ♀. Head shining black, eyes grey-brown, ocelli red, sides of frons and clypeus broadly orange-yellow; rostrum extending to the apices of the middle coxæ, black with the basal joint orange-yellow. Pronotum shining black with an orange-yellow median longitudinal fascia which converges anteriorly and posteriorly to become almost obsolete on the anterior and posterior pronotal margins; on each side of this median fascia a large round dark ferruginous-yellow spot covering the oblique sutures, the space between the two oblique sutures on each side infusate; the posterior lateral angles are sometimes ferruginous-brown or even dark yellow, in which case the light colour extends along the posterior margin of the pronotum towards the centre. Propleura fuscous with a yellow stripe extending from behind the eye towards the insertion of the tegmen, a less distinct stripe extending from the anterior tip of the pro-coxa towards the middle of the posterior margin of the propleuron, and the posterior margin itself, narrowly pale yellow. Mesonotum shining black with a yellow mark shaped like the conventional pointing hand () on each side, the "fore finger" very thin with its tip reaching the anterior margin; cruciform elevation sometimes with two small yellow spots placed side by side. Mesopleura black with the inner margin pale yellow. Opercula black with a spot at the base and the triangular metanotal appendages pale yellow. Tegmina hyaline with the veins yellow on the basal side of the corial fold and black on its apical side; the costal nerve yellow, the subcostal nerve black, and the radial nerve yellow; basal membrane yellowish-grey, sometimes suffused with orange-yellow; the first and second post-discal nervures narrowly and very obscurely infusate. Wings with the veins yellow except the apical marginal vein, which is black; the anal lobe at the base whitish, opaque. Dorsum and connexivum shining black, ventrites orange-yellow with a broad basal transverse fascia along the middle of each, black; genital segments

\* Mr. E. B. Howell says that the Wazirs call these creatures "Gingat," but he thinks that this is perhaps a general name and is not used particularly for this species.

black. Male with the penultimate ventrite black, with its base and a spot at the apex (which is slightly indentate) yellow, last ventrite blackish brown. Coxæ orange-yellow with black longitudinal stripes; trochanters orange-yellow with a black spot at the sides; femora black with the extreme apices and the undersides yellow, the front femora have a yellow stripe on each side and have the spines black; tibiæ and tarsi black, the middle and hind tibiæ with a yellow annulation at the base.

Ædeagus figured.



*Cicadatra qingai*, sp. n.

- a. Head, pronotum, and mesonotum to show colour-markings
- b. Ædeagus (ventral view) showing spined strap-like endosoma and the four strongly chitinized spine-like appendages of the phallosoma mouth (The drawing is from the dried specimen, the ædeagus being shrivelled, but the shape and number of the phallosomal spines is shown)

Measurements in millimetres —

♂. Median length of head 3.5, width of head including eyes 7.7; width of pronotum anteriorly 7.7, posteriorly 11, median length of pronotum 4.5, anterior width of mesonotum 8.5, length from base of cruciform elevation to anterior margin of mesonotum 7.4; length of tegmen 33, breadth 12.7, total length of body from anal spine to apex of frons 27.1.

♀. Total length 28.5, length of tegmen 34.



One ♂ (type) and 4 ♀ ♀, Razmak, Waziristan (N.W. Frontier, India), 6000–7000 ft., collected by Mr. E. B. Howell, I.C.S., in June 1926.

This species is allied to *C. acberi*, Dist., erroneously referred by Distant to *Psalmocharias*, Kirk.

In 1920 Haupt\* pointed out that *Psalmocharias*, Kirk. (= n. n. for *Sena*, Dist.), was doubtfully distinct from *Cicadatra*, Amyot, and split up the heterogeneous collection of species assembled by Distant† under that genus into three sections. He erected a new genus, *Chloropsaltria*, for *Ps. viridiflava*, Dist., which he tentatively placed near the end of the *Gæaninæ*, and transferred *Ps. lacteipennis*, Puton, and *Ps. semenovi*, Oshanin, back to *Tibicen*, Latr. (= *Tibicina*, Dist.). [In this it appears that Haupt is in error. *Ps. lacteipennis* and *Ps. semenovi*, Osh., both undoubtedly belong to the genus *Paharia*, Dist. *Ps. lacteipennis*, Puton, will therefore have to be known once more as *Paharia putoni*, Dist.‡, since the species again clashes with *Cephaloxys lacteipennis*, Walker, the type of the genus *Paharia*, Dist.] The remaining species Haupt retained in *Psalmocharias*, Kirk. (type *Ps. querula*, Pallas).

In 1921 Schumacher§ relegated *Psalmocharias* to the status of a subgenus of *Cicadatra*, Amyot, and restricted it to include only *Ps. querula*, Pallas, *Ps. paliuri*, Kol. (previously considered as a variety of *Ps. querula*), and *Ps. plagiifera*, Schum. (a new species from Tunis previously confused with *Ps. querula*). To these three species, however, must be added *Ps. rugipennis*, Walker, from Baluchistan. The type of this species is a rather teneral specimen without the full colouring, and Distant was misled into regarding fully coloured examples from Quetta as distinct. These specimens for some reason best known to himself he regarded as merely a large varietal form of *Ps. querula*, Pallas, and figured one as such in Faun. Br. Ind. (Rhyn.) iii. p. 135, fig. 58.

In 1923 Schumacher|| rightly refused to follow Haupt in regarding *Ps. flavicollis*, Horv., as a true *Psalmocharias*, and referred it to *Cicadatra*, near *C. alhageos*, Kol. *Ps. acberi*, Dist., which belongs to the "*flavicollis*" group, must also be removed to *Cicadatra*, subgenus *Cicadatra*.

\* Deutsch. Ent. Zeitschr. 1920, p. 409 (1921).

† Wyts. Gen. Ins. fasc. 158, *Gæaninæ*, pp. 9–10 (1914).

‡ Ann. & Mag. Nat. Hist. (6) x. p. 67 (1892).

§ Deutsch. Ent. Zeitschr. 1922, p. 183 (1922).

|| Loc. cit. 1923, p. 236 (1923).

LIII.—*The Classification of Spiders: some Comments and a Suggestion.* By THEODORE H. SAVORY, B.A.

ZOOLOGISTS regard the subject of classification from at least three different points of view. There are some who affect to despise taxonomy as the Cinderella of natural history, and there are those who, almost grudgingly, recognize that animals must be grouped into orders, families, and genera, but who sternly repress any attempt to push the division to finer intermediate stages. Finally, there are the few who realize that our classificatory schemes not only summarize the results of the labours of embryologists, morphologists and others, but that, when reasonably complete, they will tell the whole history of animal life, recording age-long experiment, success and failure in the ever-present problems of self-preservation and race-propagation. To the last class taxonomy becomes a valuable aid in the study of zoology, for, instead of remaining bound by convention, it confers its greatest benefits by becoming a live branch of the science, elastic where elasticity is desirable, and not bound down to arbitrary and probably artificial limitations. The classification of spiders, in particular, responds to such a mode of treatment, whence has arisen the scheme which I here put forward as an unpretentious suggestion.

It is not so very long since the subject of spider classification was in a state of chaos and confusion. The difficulties with which earlier workers had to contend were due in part to their ignorance of the fauna of many distant quarters of the earth, so that fresh discoveries failed to find a place in their schemes. But, in addition to this, there is the rather unusual difficulty, encountered also by ornithologists, of a surprising uniformity of structure shared by an immense number of species, living in different countries and with different habits of life. Partly because of this, many systematists went to work on fundamentally the wrong lines, endeavouring to split the order into a few large divisions, instead of a greater number of almost equivalent groups. Thus C. A. Walckenaer, in 1805, divided spiders into "*les Theraphoses*" and "*les Araignées*," which were further split into "*les Binoculées*," "*les Senoculées*," and "*les Octoculées*." P. A. Latreille, in 1809, adopted two suborders—"Quadrupulmonaires" and "Bipulmonaires,"—but sixteen years later produced a new scheme of division into tribes, based on the habits of their members. These were the *Oribitellariæ*, *Retitellariæ*, *Citigradæ*, *Laterigradæ*, *Territellariæ*, and *Saltigradæ*.

The method was followed by many naturalists, by some quite closely—as by A. Menge in ‘*Preussische Spinnen*,’—by others with trivial modifications, such as the interpolation of the groups *Vagabundæ* and *Sedentariæ*. In fact, it had more to recommend it than some of the systems which succeeded it.

Daylight began to break over the families of spiders when the amazing industry and genius of Eugène Simon produced the second edition of the ‘*Histoire Naturelle des Araignées*’ between 1892 and 1901. It cannot, however, be said that Simon’s grouping of his forty-one families was altogether fortunate, and important additions to the subject have since been made, notably by Dr. Friederich Dahl of Leipsic and by Prof. Alexander Petrunkevitch of Yale, whose latest paper is one of the most striking contributions to the systematic study of any animal group that has ever appeared. As a result of this it is now possible to take a very precise view of the paths of evolution within the order of spiders, and to express these in a system of classification which must be almost wholly natural, and not very liable to disturbance by future research, save by additions to our knowledge and in small matters of individual opinion.

It is undoubtedly true of spiders that changes in habits have played an important part in the evolution of the race, habits which now clearly divide the groups of families from each other. For example, there are the hunting spiders, three distinct races of them, originating as three separate branches of the evolutionary tree: there are at least five distinct groups of web-spinners, spinning more or less different types of web, an evolution of web-forms which it is to some extent possible to follow. [‘*Modern Science*,’ July 1926.]

All these represent different lines of development of the spider race, and, as our classifications stand at present, exist as nameless and all but unrecognized stages intermediate between the suborder and the family. It is, of course, possible to leave them unnamed, and many will wish to do so, partly from innate conservatism, partly from an apparent horror of admitting any new division between family and suborder. But if we do so, our scheme of classification is at once becoming stereotyped, ceasing to be natural, ceasing to express racial history, and losing its most valuable function of summarising existent knowledge. It becomes a dead index, in which alphabetical order would be as good as, or better than, any other.

The possible alternative is, of course, to make the family a larger body, including a greater number of genera. There are many to whom such a course would appeal—those who possess an “inclusive” type of mind, and who delight in obliterating boundaries wherever “intermediate forms” make it possible. In this way the Insecta and Myriapoda have become the Antennata, the Annelida and Arthropoda have become the Appendiculata, and so on. An obvious criticism of this process is that, carried by increase of knowledge to its logical conclusion, the whole animal kingdom becomes one phylum (or one genus), and taxonomy has disappeared. This is perhaps an idealist absurdity; the real practical drawback is the unwieldy character of the groups it produces.

It has to be realized that there is not, in the present state of our knowledge, any stage in the separation of organisms where, by fixed rule, one family or genus ends and the next begins. Our classifications are made to be of use to us, and at present workers have little hesitation in splitting a family or genus into several parts when the number of contained genera or species exceeds a useful limit. This is the antithesis of the inclusive mind—it is a mind which delights in finer and finer subdivision, in more and more precise analysis. It has this obvious justification, that its schemes become of increasing utility without losing their claims to be considered natural, while at the same time they avoid that appearance of a linear ascent through all units of the series, which is just the way by which evolution has not travelled.

For the Evolutionary Power was never an Urge which at any time decreed “Here and now shall a new family (or genus) be created.” Our division into families and genera are devices of our own subsequent invention and for our own convenience. We have to try to make them as natural, as true, as possible, and not to try to force the facts of nature into our schemes. There is always the risk of our treating our classifications with more reverence than they deserve, for families and genera, and perhaps species too, are inventions of man and not creations of Nature!

In the tentative classification of the order Araneæ which ends this paper I have adopted the following principles:—

- (i.) The families included are those of Prof. Petrunkevitch in *Ann. N.Y. Acad. Sci.* 1923, xxix. pp. 145–180.
- (ii.) Each separate evolutionary track is represented as a named group of families.
- (iii.) The names used for these new groups as far as

possible preserve some of the various terms introduced by previous workers, though not, of course, with exactly the same meaning.

(iv.) The classification expresses the following ideas:—

The Liphistiomorphæ are the most primitive of all spiders. The Mygalomorphæ, or trap-door spiders, consist of expert diggers and makers of trap-doors (Ctenizoidæ) and of hunting species (Theraphosoidæ). The Arachnomorphæ include all remaining spiders. The Tubitelariæ are the most primitive of these, and recall *Liphistius* in several ways. The Hypochilidæ have always been a difficulty, because, like the Mygalomorphæ, they possess two pairs of lungs, and this has made some authors give them a place in that division. This combination of the characters of the two suborders is probably best expressed by regarding the family as an Arachnomorph one, which retains certain of the more primitive characters. The remaining spiders divide themselves naturally into those with two tarsal claws and those with three. The former are hunters, and include forms which have specialized in rapid darts sideways and others which have specialized in leaping; the latter are all web-spinners, save the Citigradæ, a specialized offshoot of three-clawed hunters. They probably arose from or near the species grouped as Stichotrichiæ, which spin a primitive type of web and from which the other two tribes are derived.

### Order ARANEE.

#### Suborder LIPHISTIOMORPHÆ.

Families *Liphistiida*, *Arthrolycosida*, *Arthromygalida*.

#### Suborder MYGALOMORPHÆ.

##### Tribe CTENIZOIDÆ.

Families *Ctenizida*, *Migida*, *Atypida*, *Paratropidida*.

##### Tribe THERAPHOSOIDÆ.

Families *Theraphosida*, *Barychelida*, *Diplurida*, *Pycnothelida*.

Suborder ARACHNOMORPHÆ.

Division TUBITELARIÆ.

Tribe TUBITELÆ.

Grade TETRAPNEUMONES.

Family *Hypochilidæ*.

Grade DIPNEUMONES.

Families *Filistatidæ*, *Sicariidæ*, *Amoxenidæ*, *Dysderidæ*, *Oonopidæ*, *Prodidomidæ*, *Telemidæ*, *Leptonetidæ*, *Ecobidæ*, *Urocteidæ*.

Grade APNEUMONES.

Family *Caponiidæ*.

Division BIUNGUICULATÆ.

Tribe VAGABUNDÆ.

Grade OLIGOTRICHÆ.

Families *Tengellidæ*, *Zoropsidæ*, *Drassidæ*, *Selenopidæ*, *Clubionidæ*, *Platoridæ*, *Homalonychidæ*, *Ctenidæ*, *Acanthoctenidæ*.

Grade LATERIGRADÆ.

Families *Thomisidæ*, *Aphanthochilidæ*, *Sparassidæ*.

Grade SALTIGRADÆ.

Families *Salticidæ*, *Parattidæ*.

Division TRIUNGUICULATÆ.

Tribe STICHOTRICHÆ.

Families *Amaurobuidæ*, *Psecridæ*, *Agelenidæ*, *Hersiliidæ*.

Tribe CITIGRADÆ.

Families *Palpimanidæ*, *Zodariidæ*, *Eresidæ*, *Pisauridæ*, *Lycosidæ*, *Senoculidæ*, *Oxyopidæ*.

Tribe RETITELARIÆ.

Families *Dictynidæ*, *Pholcidæ*, *Archeidæ*, *Linyphiidæ*, *Theridiidæ*.

Tribe ORBITELARIÆ.

Families *Uloboridæ*, *Dinopidæ*, *Mimetidæ*, *Epeiridæ*.

## BIBLIOGRAPHICAL NOTICES.

*British Snails, a Guide to the Non-Marine Gastropoda of Great Britain and Ireland, Pliocene to Recent.* By ARTHUR ERSKINE ELLIS. With Illustrations by R. A. ELLIS. Pp. 275, with 14 Plates. Oxford: Clarendon Press, 1926.

A HANDY work of reference, giving in a convenient form descriptions and figures of all the British non-marine Gastropods. It will certainly prove to be of service to many field-naturalists, even to those unfamiliar with the subject. Part I., Introductory, deals with the structure of the snail, classification of the Mollusca, origin of non-marine Mollusca, and collecting, and also includes a classified list and a synopsis of the genera of recent British non marine Gastropoda; Part II., Descriptions of Species: Operculate (Streptoneura) and Pulmonate Snails, the latter including two sections, Basommatophora and Stylommatophora. The author (p. 24) gives the number of known species of Mollusca as 60,000, compared with 55,000 for Vertebrates and 470,000 for Insecta.

*Descriptions of new Genera and Species of Lepidoptera Phalaenæ of the Subfamily Noctuinae (Noctuidæ) in the British Museum.* By Sir GEORGE HAMPSON, Bart. Pp. iv & 641. London: British Museum of Natural History, issued 24th April, 1926.

THIS volume contains descriptions of all the new genera (239) and species (many hundreds) of the Noctuid subfamily Noctuinae left in MSS. by the author on his retirement from the Museum in 1920. Thirteen volumes and two supplements of the 'Catalogue of Phalaenæ' had so far been published, the last [a Supplement II. to the Lithosiadæ (Arctianæ) and Phalaenoididæ] having been issued in the same year. The MSS., as a whole, formed five volumes of the Noctuinae, and the descriptions have been extracted from it and published in one volume, as there was an obvious risk of the unpublished names, under which the insects have been labelled for the past six years, being used by students of the National Collection. Whether the appalling number of new genera, many of which are monotypic, can be identified without the author's keys (presumably included in the MSS.) is perhaps doubtful. An indication of the habitat of those based on a single known species (a full reference to the description of which is given), *Metaprionota* for example (p. 1), would certainly have been of some assistance to anyone attempting to name moths of this group. No figures are given.

## PROCEEDINGS OF LEARNED SOCIETIES.

## GEOLOGICAL SOCIETY.

April 21st, 1926.—Dr. F. A. Bather, M.A., F.R.S.,  
President, in the Chair.

The following communications were read :—

1. 'On a Rock-Building Bryozoan with Phosphatized Skeleton from the Basal Arenig Rocks of Ffestiniog (North Wales).' By Herbert Price Lewis, M.A., F.G.S.

During the last forty years various authors have recorded the occurrence of black, usually ovoid masses in the basal Arenig rocks (Garth Grit) on both sides of the Harlech Dome. These masses have been designated 'lumps,' 'pebbles,' and 'nodules.' Their delicate concentric shell-structure has been regarded as due to contraction, and the fractured surfaces as presenting a curious resemblance to Nummulites. Other writers have observed that they show 'a number of "oolitic" grains.'

The Author, on the evidence of etched surfaces and microscope-sections, has found that the structure of these masses was originally organic, but modified later by inorganic processes.

A new genus is described, and referred to the *Ceramoporidæ* of Ulrich. This genus is represented by one species—the earliest bryozoan known in British rocks. The species was responsible for the building-up of the nodular masses, which have been proved by analysis to contain a large amount of calcium phosphate.

The stratigraphy of the deposit containing the described fossils is dealt with by Prof. W. G. Fearnside.

2. 'The Geology of the Cayman Islands (British West Indies), and their Relation to the Bartlett Trough.' By Charles Alfred Matley, D.Sc., F.G.S. With an Appendix on the Species of *Lepidocyclus* and *Carpenteria* from Cayman Brac and their Geological Significance, by Thomas Wayland Vaughan, Ph.D., For. Corresp. G.S.

The Cayman Islands, a dependency of Jamaica, are an isolated group of three islands, with an area of 100 square miles, all very similar in their geological structure and history, although each is a separate faulted block.

The islands are built entirely of calcareous rocks which are free from terrigenous materials other than fine dust. There are two formations present, an older Bluff Limestone, and a newer, Ironshore Formation, lying unconformably upon the former,



which makes a coastal terrace with a maximum height of 12 to 15 feet above the sea.

The Bluff Limestone, a white, massive, semicrystalline limestone, containing casts of mollusca, badly preserved corals, nullipores, and foraminifera, resembles lithologically many parts of the White Limestone of Jamaica. The discovery on Cayman Brac of a bed rich in *Lepidocyclina undosa* Cushman, *L. gigas* Cushman, *L. yurnagunensis* Cushman, and other forms, fixes the horizon in that island as Middle Oligocene, and enables us to correlate it with a zone containing *L. undosa* (associated with *L. cf. gigas*), which the Author has traced over many parts of Jamaica in the White Limestone.

In Little Cayman and Grand Cayman, the Bluff Limestone appears, from the meagre palæontological evidence obtained, to be of Miocene age; on general considerations, the Author thinks that its age there is not likely to be newer than Lower Miocene. The thickly-forested surface of the limestone, which makes an upper platform or plateau on each island, is a karstland in an advanced stage of development. The plateau appears to have been formed by marine planation, and to have developed a slight westward tilt in the course of elevation, so that the western end of each island remained just below sea-level.

On the coastal shelf formed round each island by marine erosion the calcareous Ironshore Formation, with its mollusca and corals of living species, was deposited. Its emergence, in Pleistocene or recent times, as a low platform backed by the ancient cliffs, is considered to be probably the result of a fall of sea-level. It is compared with the Falmouth Terrace of Jamaica and other similar low coastal terraces of the West Indies. The off-shore platform seems to have been subjected to submergence, also due to change of sea-level, and the recent coral-reefs have been formed on this shelf.

The almost completely submerged Cayman Ridge on which the islands stand, and the Bartlett Trough which flanks it on the south, are described and examined in the light of the Wegener hypothesis, and it is suggested that the Cayman Islands and the submerged parts of the ridge may once have lain near the Jamaica-Honduras ridge, with Jamaica itself confronting the Sierra Maestra of Cuba; further, that the separation has taken place by the development of a great crustal fissure (initiated probably in Pliocene, or at the earliest in Middle Miocene, times) which has widened until it has become the Bartlett Trough.

Dr. T. W. Vaughan contributes an Appendix on the Middle Oligocene foraminifera from Cayman Brac. He correlates the formation in which they occur with the Antigua Formation of Antigua, the Glendon Formation of the Gulf States, and the Meson Formation of Mexico. Some of the characteristic species are also known from the Oligocene of Jamaica and Eastern Cuba.

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LIV.—*Pycnactis*, *Mesactis*, *Phaulactis*, *gen. nov.*, and  
*Dinophyllum*, *Lind.* By T. A. RYDER, B.Sc.

[Plates IX.-XII.]

INTRODUCTION.

The three new genera of simple Silurian corals here described (*Pycnactis*, *Mesactis*, and *Phaulactis*) are cognate forms and illustrate, within a single lineage, three stages in a definite line of development, namely, diminution of secondary thickening. *Pycnactis* is a "Zaphrentoid" form in which excessive secondary thickening of the tissue is a characteristic feature; *Mesactis* shows this thickening in a lesser degree, whilst in *Phaulactis* the tissue is almost normal. The paper also takes notice of *Dinophyllum*, Lindström, describes a new species of that genus and discusses its development.

The material described is, in part, my own collecting and, in part, has been supplied by the Geological Collections of the University of Bristol, and for access to these I thank Professor S. H. Reynolds. I am also indebted for certain useful specimens from Gothland to Dr. J. E. Hede of the Geological Survey of Sweden. I thank Dr. Stanley Smith and Dr. W. D. Lang for much helpful criticism and advice.

The research has been carried out at the University of Bristol by the aid of grants from the Department of Scientific and Industrial Research and the Gloucestershire Education Committee, and to these bodies my thanks are also tendered.

### PYCNACTIS, gen. nov.

*Definition of Genus.*—Simple, horn-shaped (trochoid), rugose coral, in which the major septa are well developed and extend to the centre of the corallum, whilst the minor septa are very short; and in which the septa of both cycles are strongly dilated throughout their length. The cardinal septum is very conspicuous in brephic stages. Tabulæ and dissepiments are suppressed.

Genotype. *Hippurites mitratus*, Schlothheim.

### *Pycnactis mitratus*, Schl.

#### *Synonymy.*—

- † 1745. *Madrepora simplex, turbinata, laevis, stella, concava*, var.  $\epsilon$ , Linnæus, *Dissertatio Corallia Baltica*, pp. 15 & 18, fig. vii.; reprinted, 1749, in *Amœnitates Academica*, pp. 87 & 90, pl. iv. fig. vii.
- † 1758. *Madrepora turbinata* (partim), Linnæus, *Systema Naturæ*, 10th ed. p. 793.
- 1820. *Hippurites mitratus*, partim, Schlothheim, *Die Petrefactenkunde*, 1st part, p. 352.
- 1831. *Turbinolia obliqua*, Hisinger, *Antechn. i Phys. och Geogn.* vol. v. p. 128, pl. viii. fig. 7; not necessarily *T. furcata*, Hisinger, *op. cit.* p. 128, pl. vii. fig. 4.
- 1837. *Turbinolia mitrata*, var. *obliqua*, Hisinger, *Lethæa Svecica*, p. 100, pl. xxviii. fig. 10; probably, but not necessarily, *T. mitratum*, var. *furcata*, loc. cit. fig. 11, but not *T. mitrata*, loc. cit. fig. 9.
- 1851. *Aulacophyllum mitratum*, H. M. Edwards and Jules Haime, *Pol. Foss. des Terr. Paleoz. (Arch. de Mus. vol. v.)* p. 356, pl. ii. fig. 6.
- 1854. *Aulacophyllum mitratum*, H. M. Edwards and Jules Haime, *Brit. Foss. Corals*, p. 280, pl. lxvi. figs. 1, 1 a, 1 b.
- 1882. *Cyathophyllum mitratum*, Lindström, *Översigt af Kongl. Vetenskaps-Akademiens, Förhandlingar*, no. 3, p. 30.
- 1883. *Aulacophyllum mitratum*, F. Römer, *Leth. Pal.* p. 375.
- 1894. *Halkia mitrata*, Weissert, *Zeit. deutsch. geol. Gesell.* vol. xvi. pp. 614-616, pl. xlviii. figs. 5-7.
- 1896. *Cyathophyllum mitratum*, Lindström, *Översigt af Kongl. Vetenskaps-Akademiens, Förhandlingar*, no. 9, pp. 627-8 & 640.

This synonymy is by no means complete, only a few of the more important works having been noticed. It is impossible to say whether the species is or is not represented by Linnæus' figure, but it is considered to be so by Lindström

(1896). It is agreed by most authors that it is in part *Hippurites mitratus* of Schlotheim, and it is certainly *Turbinolia mitratum*, var. *obliqua* of Hisinger. *Hippurites mitratus*, Schl., restricted, has been by various authors subsequently described under *Cyathophyllum*, *Aulacophyllum*, and *Hallia*. I consider the species not to be congeneric with any of those genera, and here propose for it the new generic name of *Pycnactis*.

*P. mitratus* does not possess the dominant cardinal septum so well seen in and characteristic of *Hallia*, Ed. & Haime\*, nor has it on its cardinal side the well-marked fossula of *Aulacophyllum*, Ed. & Haime†; the fossula in *P. mitratus* is insignificant, and may occur on either the convex or concave side of the corallite. Furthermore, neither of these *Hallia* nor *Aulacophyllum* exhibit the remarkable septal dilatation characteristic of *Pycnactis*.

#### Description ‡.

*External Characters*.—*P. mitratus* is a small, horn-shaped (trochoid), rugose coral varying up to 40 mm. in length and 17 mm. in diameter. The external surface of the epitheca is slightly longitudinally striated, and a somewhat feeble annulation may be developed. The calyx is moderately deep, and is bounded by a thin erect wall. The septa appear as ridges running from the sharp rim of the calyx down to the centre of the floor. There is no conspicuous fossula or dominant cardinal septum, but the symmetry in the adult calyx is pinnate.

*Internal Characters* (Pl. IX. figs. 1-7).—The much dilated and, consequently, closely packed septa which occupy almost the whole of the interior of the coral to the exclusion of intra-septal tissue, both tabular and dissepimental, give the species its most characteristic feature. The septa are fused to each other at points along their length where there is excess thickening (Pl. IX. figs. 5-7). There are about 36 major and an equal number of minor septa in a corallite of 15 mm. diameter. The major septa extend from the epitheca to, or almost to, the centre of the corallum, where their inner ends become attenuated and often slightly twisted, as shown in Pl. IX. figs. 6 & 7. The minor septa are short, usually less than one-third the length of the major.

\* Milne-Edwards and Jules Haime, Brit. Foss. Corals, p. lxvii.

† *Loc. cit.* It may be noted that certain American palæontologists regard *Hallia* and *Aulacophyllum* as congeneric; *vide* Dr. Bassler, private communication to Dr. Stanley Smith.

‡ More than 700 specimens have been examined for this description.

*Ontogeny and Development of Pycnactis* \*.—The septal development in this genus is interesting, since it shows, in its earliest stages, variations from the plan described by Carruthers †. The earliest stage observed showed the epithecal ring with one long septum (the "axial septum" of Carruthers) completely bisecting the calicle. Two small septa then appear near the cardinal end of the axial septum, and these, as they develop, move away towards the counter side of the corallum until they assume an angle relative to the axial septum of approximately  $75^{\circ}$ . When this arrangement is attained, the axial septum breaks up into a long cardinal and a short counter septum (see text-fig. 1).

A pair of "counter-lateral" septa is then inserted, but these do not develop at equal rates, nor is there a pause in septal insertion to allow the six septa now present to become equally developed and attain radially as described by Carruthers. The first counter-lateral pair of septa behave, in fact, like any other pair of metasepta.

The remainder of the metasepta are inserted in bilateral pairs at four points, viz., the cardinal, the counter, and the two altar, fossulæ. The newly-inserted septa as they develop move away from their place of origin, so leaving room for the insertion of further metasepta.

There is, therefore, in *Pycnactis*, at all events, evidence for a primary tetrameral septal plan ‡.

The septa are much dilated by stereoplasmic thickening at all stages of their development. The first crop of minor septa do not appear until the coral is more than half grown, when they appear as small knobs between the peripheral ends of the major septa. Both major and minor septa have a dark medial line in cross-section. The major septa reach the centre of the corallum at all stages of

\* Three methods were made use of in investigating the early developmental stages of this and other genera:—

- a. Serial sectioning: this method, although wasteful of material, gave permanent records, but orientation of the sections was often difficult.
- b. Careful examination of the outer surface of the coral, and accurately projecting the septal ridges and grooves as a plan.
- c. Rubbing down the proximal end of coral with fine emery powder and water on a glass plate and carefully sketching each successive stage. This method gave no permanent record of the stages, but more stages were obtainable and correct orientation was always assured.

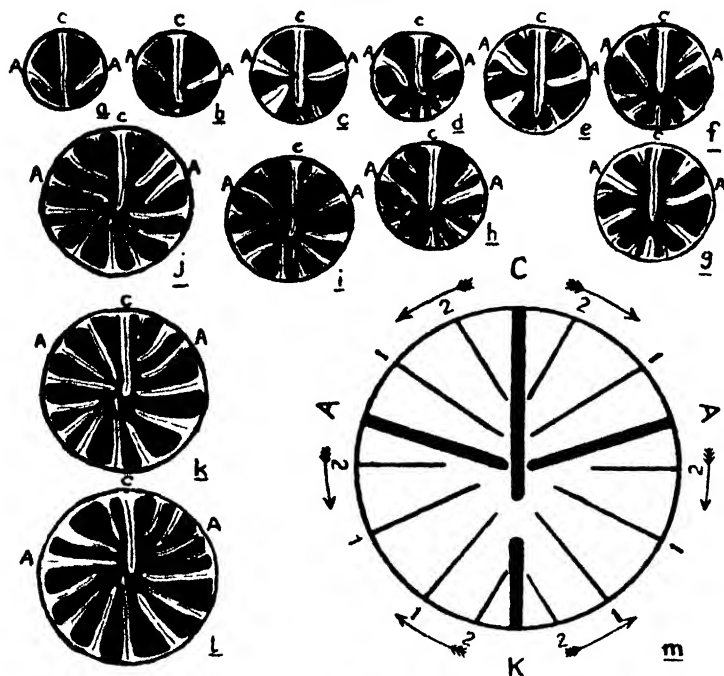
† Carruthers, Ann. & Mag. Nat. Hist. (7) vol. xviii. pp. 109-127 (1906).

‡ Carruthers, *op. cit.* p. 127.

growth, except at maturity, when there may be a slight decrease in the amount of dilatation of their inner ends, often accompanied by a retreat of the attenuated portions of the septa (Pl. IX. figs. 6 & 7).

*Localities and Horizons.*—Most of the material has been collected at Brinkmarsh and other quarries near Whitfield, Gloucestershire, where the species is abundant in a red shale of Wenlock age\*. Specimens have also been examined

Text-fig. 1.



Early developmental stages of *Pycnactis mitratus*, Sch.

a, b, d, f-l, from same individual; c and e, from another individual. All magnified approx. 10-12 diam. m, diagram to illustrate septal insertion in *P. mitrata*, Sch.

C=cardinal septum; K=counter septum; AA=alar septa.

from the Island of Gothland, Baltic Sea; Marloes, Pembrokeshire; Woolhope, Herefordshire; Malvern, Worcestershire;

\* See Reed and Reynolds, Quart. Journ. Geol. Soc. vol. lxiv. (1908) pp. 525-528.

May Hill, Gloucestershire. In all cases the horizon has been the same, viz., Wenlock Limestone.

*Pycnactis mitratus*, var. *grandis*, nov.

In all essential characters this form resembles *P. mitratus*, Schl., differing from it only in attaining a much larger size, e. g., 36 mm. diameter in a length of 72 mm. So far it has only been recorded from the Wenlock Beds of May Hill, Gloucestershire.

*Pycnactis rhizophylloides*, sp. n. (Pl. IX. fig. 8.)

This species differs only in external characters from *P. mitratus* (Schl.). It is a simple trochoid coral, but is semicircular in transverse section, and is flattened on the convex (cardinal) side of the corallum throughout its entire length, whilst its proximal end is more strongly curved than in the type-species.

A somewhat similar form has also been described from Gothland by Lindström as *Hallia calceolides* \*. Later Lindström made this the genotype of his genus *Holophragma* †. Lindström's coral differs from the coral described above in having a prominent cardinal septum, well seen in the floor of the calyx, and forming a conspicuous ridge running down the outside of the epitheca on the convex flattened side of the corallum, as well as in being semicircular only in the early stages, while it becomes more or less circular in the adult; in *P. rhizophylloides* the cross-sections are semicircular at all stages.

*Locality and Horizon*.—Wenlock, Island of Gothland.

MESACTIS, gen. nov.

*Definition of Genus*.—Simple, horn-shaped (trochoid), rugose coral, which in its immature stages has the characters of *Pycnactis*, but which in mature stages differs from that genus by developing transverse tissue and in reduction of septal dilatation at the periphery.

Genotype (genoholotype). *Mesactis glevensis*, sp. n. Wenlock Beds, Brinkmarsh Quarry, near Whitfield, Gloucestershire.

\* Lindström, Geol. Mag. vol. iii. 1866, pp. 356-362, and pp. 406-414, pl. xiv. figs. 19-23.

† Lindström, 1896, Bihang. Kongl. Svenska Vetenskaps-Akademiens, Handlingar, vol. xxi. no. 7, pp. 4-50, pls. i.-viii. (1896).

*Mesactis glevensis*, sp. n.

*External Characters*.—The corallum, which may attain a diameter of 18 mm. in a length of 47 mm., is usually more cylindrical than that of *P. mitratus*, Schl. Its calyx is moderately deep. The epitheca exhibits feeble annulation, and is but slightly longitudinally striated.

*Internal Characters* (Pl. X. figs. 3–6).—The coral, as seen in cross-section, is bi-areal; there is an outer zone of dissepiments and an inner area occupied only by the septa and a little intra-septal tissue. The septa are united at their outer ends to the epitheca; the major (about 40 are present in a coral of 18 mm. diameter), which are slightly flexuous, usually extend almost but not quite to the centre of the corallum. The minor septa, although better developed than in *P. mitratus* (Schl.), are only about one-third the length of the major. The septa of both cycles are greatly dilated in immature stages, as in *Pycnactis*. The dissepimental area consists of four or five rows of fine dissepiments, convex distally, and is approximately one-sixth the diameter of the corallite. The theca may or may not be distinct, being in some cases only marked by secondary thickening. The cardinal fossula is not prominent in the adult, but it is always well marked in early stages. Longitudinal sections do not display any ordinary tabulæ, but some form of transverse tissue is undoubtedly responsible for the intra-septal tissue seen in cross-sections.

*Ontogeny* (Pl. IX. figs. 9–18 and Pl. X. figs. 1 & 2).—The brephic\* and early neanic stages of *Mesactis* and *Pycnactis mitratus* (Schl.) agree in all respects, the septa are very dilated and reach the centre of the corallum, and the cardinal septum is dominant, being longer and thicker than the rest. Septal insertion takes place in bilateral pairs at the cardinal and alar fossulæ, and possibly also at the counter fossula.

Reduction in septal dilatation begins at the periphery and works inwards; and there is a slight retreat of the septa from the centre as the adult stage is reached, and this area is often occupied by a mass of secondary thickening (Pl. X. figs. 4 & 5). Dissepimental tissue appears as the peripheral area is cleared of stereoplasm (Pl. IX. figs. 16–18 and

\* None of the specimens examined had tips sufficiently well preserved to admit of the detailed study of the early developmental stages that was carried out for *P. mitratus*, Schl.



Pl. X. figs. 1-8). As maturity is reached the septa assume a quasi-radial symmetry, and the position of the cardinal fossula is only indicated by the fact that the major septa in close proximity to it always remain slightly dilated (fig. 8).

*Localities and Horizon.*—Wenlock Beds, Brinkmarsh Quarry, near Whitfield, Gloucestershire, where the species occurs in association with *P. mitratus* (Schl.) in a red calcareous shale, the Lower Ludlow, Blaisdon, Gloucestershire.

PHAULACTIS, gen. nov.

*Definition of Genus.*—Simple, horn-shaped, rugose coral which exhibits in its brephic stages the characters of *Pycnactis* and in neanic stages those of *Mesactis*, but which, in the mature stage, differs from those genera in a much greater development of transverse tissue and much greater reduction of septal dilation. Tabulæ and dissepiments are well developed, and the corallite attains a greater size and the septa are more numerous than in the genera mentioned.

*Genotype.* *Phaulactis cyathophylloides*, sp. n. Silurian. Slite Group (Wenlock?), Vastergarn, Island of Gothland.

*Phaulactis cyathophylloides*, sp. n.

*External Characters* (Pl. XI. fig. 6).—The corallum may be turbinate or cylindrical, in the former case it attains a diameter of 20 mm. in a length of 35 mm., whilst in the cylindrical form the diameter is usually less, although the length may be between 50 and 60 mm. The calyx is very deep, and annulation is well marked.

*Internal Characters* (Pl. XI. figs. 1-5 and Pl. XII. fig. 1).—The distinct bi-areal character of the species is well seen both in transverse and longitudinal sections. There is a wide outer dissepimental zone, usually half or slightly less than half the radius, built up of from six to twelve rows of small, distally curved, closely-set dissepiments, and an inner tubular area filled with irregular tabellæ.

The septa are thin and slightly flexuous—the major extend almost to the centre of the corallum and the minor about two-thirds of that distance. The minor septa may become slightly discontinuous within the dissepimental area. There are, approximately, 40 septa in each cycle in a coral of 22 mm. diameter and 37 in each cycle in one of 21 mm. diameter.

The coral is characterised by the absence of secondary thickening in the adult, except locally about the cardinal fossula; this is observable in longitudinal and transverse sections (Pl. XI. figs. 3-5).

*Localities and Horizon.*—The bulk of the material examined was from the Slite Group (? Wenlock) of the Island of Gothland. Typical specimens, however, have been found in the Wenlock Beds of Ironbridge, Shropshire, and Lower Ludlow, Blaisdon, Gloucestershire.

*Phaulactis cambrensis*, sp. n.

*External Characters.*—This species agrees with *P. cyathophylloides* in most of its external characters, but differs in its smaller size. All the specimens examined were so weathered that the character of the calyx was not determinable.

*Internal Characters* (Pl. XI. figs. 7 & 8).—The major septa remain more or less dilated, even when maturity is attained, especially in the cardinal quadrants; in the counter quadrants they are of normal thickness when traversing the dissepimental area, but are slightly dilated in the intra-theclal region (Pl. XI. fig. 7). The minor septa are feebly developed, rarely extending beyond the theca. The dissepimental area is narrower than in the type-species, and is composed of from four to six rows of small convex plates. The theca is well marked in transverse section by secondary tissue. The tabulæ are characteristic of the species, and form the most important difference between it and *P. cyathophylloides*. They are broad, slightly curved distally, and are fairly closely set (Pl. XI. fig. 8). The early stages of *P. cambrensis*, as far as has been ascertained, closely resemble those of *P. cyathophylloides*.

*Localities and Horizon.*—The specimens on which the species has been founded were from the Wenlock Beds of Penylan Hill, on the north-east side of Cardiff, but the form occurs in rocks of the same age in the Island of Gothland.

*Ontogeny of Phaulactis and Phylogeny of the Pycnactis-Phaulactis Group.*

*Phaulactis cyathophylloides* passes, in its development, through a *Pycnactis* and a *Mesactis* stage. The former—*Pycnactis* stage—is condensed within the brephic and very early neanic phases of growth, whilst the latter—*Mesactis* stage—is represented in *Phaulactis* by the late neanic stages. The characters distinctive of the genus appear before the end of the latter stage.

Although *Pycnactis*, *Mesactis*, and *Phaulactis* occur at the same horizon, the three corals undoubtedly represent three stages in the evolution of the more specialised *Phaulactis*, and that genus illustrates admirably, in the condensation of

*Pycnactis* and *Mesactis* characters, the principle of tachygenesis.

*Phaulactis cambrensis* forms a link between the genotype of *Phaulactis* and the less specialised *Mesactis glevensis*.

*Pycnactis rhizophylloides* is, no doubt, the ancestor of *Holophragma*, Lind., and unites that coral with the *Pycnactis-Phaulactis* stock. The exaggerated cardinal septum of *Holophragma calceolides*, Lind., may be co-ordinated with the development of an operculum; this feature is also seen in

Text-fig. 2. (Not to scale.)

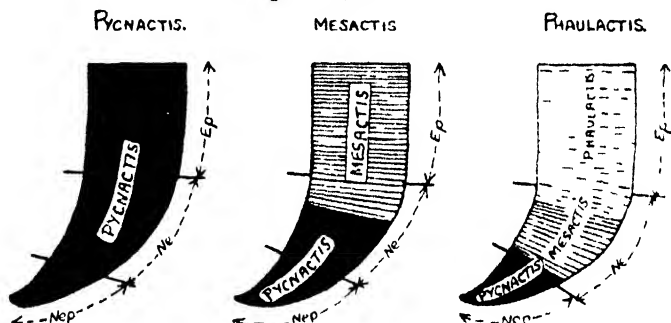


Diagram illustrating the phylogeny of the *Pycnactis-Phaulactis* group and tachygenesis in *Phaulactis cyathophylloides*.

*Nep*=nepionic or brephic; *Ne*=neanic; *Ep*=ephebic. The proportions of the nepionic and neanic stages are exaggerated in proportion to that of the ephebic.

*Rhizophyllum gothlandicum*, Lindström, *Goniophyllum pyramidalis* (Hisinger), and *Calceola sandalina* (Gmelin).

### *The Genus Dinophyllum, Lindström, 1882.*

"Silurisch korallen aus Nord-Russland und Siberien," Bihand till K. Svenska Vet.-Akad. Handlingar, Band vi. no. 18, pp. 5, 21.

Genotype. *D. involutum*, Lindström, *op. cit.* pp. 5, 21. No figure. Described as from the Silurian rocks of Olenek\*. Also recorded by Lindström, p. 5, from the Upper Silurian of Sweden and from Gothland.

### *Dinophyllum involutum, Lindström.*

*External Characters* (Pl. XII. fig. 11).—Simple, trochoid, rugose coral, attaining a diameter of 19 mm. at a length of 29 mm. The largest specimen examined was 26 mm. diameter

\* Olenek is the name of a river in the province of Yakuts, North Siberia.

across the calyx \*. Epitheca moderately smooth, as annulation is only slightly developed. The calyx is deep with steep inner walls and a flat central area from which the crested boss of the columella arises. This boss is elongated in the plane of the cardinal septum. The major septa stand out as ridges running from rim of cup to the floor of the calyx, and often abutting against the columella. The minor septa are also seen as ridges on the inner walls, but do not extend to the floor. A calyx 26 mm. diameter has 45 septa in each cycle, and one 19 mm. diameter 35 in each cycle. The fossulae are not noticeable in the calyx, but the position of the cardinal fossula is indicated by the elongation of the columellar boss towards it.

*Internal Characters* (Pl. XII. figs. 7-10).—In cross-sections the major septa reach the columella, whilst the minor septa are short, being only one-third the length of the major. The cardinal fossula is often well marked. No dissepimental tissue is seen in either horizontal or vertical sections. Widely set, thickened tabulae (5 tabulae in a vertical distance of 8 mm.) are present; they are irregularly curved and stretch from the thickened peripheral zone to the columella. The large, solid, spindle-shaped columella which may occupy one-eighth of the diameter of the corallite is, in all stages, united to the cardinal and, in most cases, to the counter septum as well. Throughout growth there is always a certain amount of secondary thickening present. This is of a different type from that in *Pycnactis*; the septa are not themselves dilated, but the inter-septal spaces are, near the periphery, filled with stereoplasm which in the adult extends inwards almost the entire length of the minor septa.

*Ontogeny*.—See ontogeny of *D. minimum*, sp. n.

*Localities and Horizons*.—All the specimens examined were from the Wenlock Beds of the Island of Gothland, Baltic Sea.

### *Dinophyllum minimum*, sp. n.

The material on which this new species is founded was from the Wenlock Beds of the Island of Gothland, Baltic Sea.

*External Description* (Pl. XII. fig. 2).—A simple trochoid coral of which the largest specimen examined was 12 mm. diameter and 26 mm. in length, although the usual diameter is about 9 mm. The epitheca is smooth, annulation being feebly developed. The calyx is moderately deep,

\* Lindström gives measurements of one of his specimens as 41 mm. long and 31 mm. in diameter.

with a small boss, the distal termination of the columella, arising from the flattened floor. The columellar boss and the cardinal septum are often united by a slight ridge on the floor of the calyx. There were 25 major septa in a calyx diameter 12 mm., 22 in one of diameter 9.5 mm. Attachment-scars are often seen on the lower portion of the convex side of the corallite (Pl. XII. fig. 2). Two forms of corallite occur, one short, squat, and turbinate, the other elongated, this latter with the calyx usually set oblique to the axis of growth.

*Internal Characters* (Pl. XII. figs. 3-6).—The major septa \* are, as a rule, shorter than in *D. involutum* and do not reach the columella, and the minor septa are very feebly developed. A characteristic feature of this species is the manner in which the major septa in the cardinal quadrants unite at their inner ends in groups of three or four (Pl. XII. figs. 3-5). The cardinal and counter septa are usually united to the columella, which is a solid structure. The tabulæ are highly inclined and far apart, and there is no trace of dissepimental tissue. Secondary thickening is not very marked in this species, and is confined to a narrow zone immediately within the epitheca. The columella is relatively smaller and less regular in form than in the type-species.

#### Ontogeny of *D. minimum*. (Text-fig. 3.)

In the brephic stages an axial septum, more or less dilated in the middle, bisects the transverse section. The other septa present fuse with this, and the alar septa lie approximately at right angles to it. Septal insertion takes place at the cardinal and alar fossulæ in the normal way, and each septum as it is inserted is directed toward and fuses with the last-formed septum in its quadrant.

During the neanic stages the thickened middle part of the

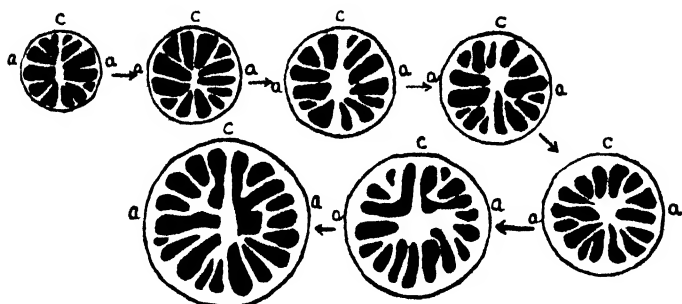
\* The following measurements show relation of size to number of septa in three specimens:—

Diameter of corallite.	No. of major septa.	Distance from tip.
mm.		mm.
8	25	9
8.5	27	8
7.5	23	6

axial septum develops into the columella \*, and the septa, in the cardinal quadrants especially, begin to unite in groups at their axial ends (see diagram).

Secondary thickening in the ephelbic stage in this species is not so marked as it is in the type-species.

Text-fig. 3.



Early developmental stages of *Dinophyllum minimus*.

All figures from one individual. All multiplied by approximately 5 diameters. Earliest stage about 1 mm. from proximal end. Cardinal septum (c) on top of figure in all cases. a=alar septum.

### *Trends in Silurian Rugosa illustrated by Genera described in this Paper.*

Several well-defined trends † have been observed in the simple corals examined :—

#### i. *Reduction of Stereoplasm.*

In the course of this research two forms of stereoplasmic or secondary thickening have been observed. In *Pycnactis*, *Mesactis*, and *Phaulactis* there is an actual dilation of the septa up to five or six times the normal width, but each septum retains its own boundary-wall and dark medial line. A different form of thickening is seen in *Streptepasma*, Hall, and *Dinophyllum*, Lind. In these genera each septum retains its normal thickness, but the areas between neighbouring

\* Smith and Benson (Quart. Journ. Geol. Soc. vol. lxxix. (1923) pp. 163-164) have suggested that the columellæ of certain Carboniferous *Rugosa* arise in this manner, by dilation of the central portion of the axial septum.

† The term "trend" is used in the sense used by W. D. Lang, Proc. Geol. Assoc. vol. xxxiv. (1923) pp. 120-136.

septa are filled in by secondary tissue. The boundary-walls and dark medial line of the unthickened septa can be traced through the stereoplasmic mass. This infilling apparently spreads out from the sides of each septum and coalesces along a line between adjacent septa, since a dark line is also often visible there.

(a) *Phaulactis* trend.—In this very definite trend so strikingly exemplified in *Pycnactis*, *Mesactis*, and *Phaulactis* there is a progressive reduction in the thickness of the septa and reversion to normal type, both in the life-histories of each species and in the phylogeny of the group as a whole. In *Pycnactis* this attenuation begins at the inner ends of the septa and progresses outwards, whilst in *Mesactis* and *Phaulactis* the reduction commences at the peripheral ends of the septa and works inwards. In these latter genera, also, the last septa to remain thickened are those immediately adjoining the cardinal fossula.

(b) *Streptelasma* trend.—This trend, well seen in *Streptelasma*, Hall, and *Dinophyllum*, Lind., is evidenced by a gradual reduction in the amount of stereoplasmic thickening from the interior of the corallite towards the epitheca. The minor septa, completely embedded in secondary thickening in early stages, are gradually freed from it, until in mature sections the only trace of secondary thickening is a narrow area immediately within the epitheca.

It is interesting to note that whereas in Carboniferous corals it is in old age that secondary thickening is most important, in the simple Silurian Rugosa mentioned it is in the early stages that maximum thickening is seen\*, and in all

\* Table to show decrease in amount of secondary thickening in *Streptelasma corniculum*, Hall, with increasing size and attainment of maturity:—

Specimen.	Distance from proximal end.	Diameter of corallite.	Width of thickened area.	% of thickened area to that of corallite.
A .....	mm. 63	mm. 37	mm. 4	23
A .....	39	21	6	53
B .....	70	31	3	18
B .....	53	29	3.5	23
B .....	30	22	3	26

the genera examined during this work the attainment of maturity sees a reduction of this thickening to a greater or less extent, depending on the genus in question.

## ii. Shape of Corallite.

The rugose corals are usually more or less circular in transverse section, and only occasionally does one find marked departure from the usual habit in this respect. The development of pyramidal and slipper-shaped corals mentioned below is associated with the development of opercula\*.

(a) *Goniophylloid* trend.—Genera exhibiting this trend show a tendency to become rectangular in section, and the development culminates in *Goniophyllum*, Ed. & Haime, with its almost perfectly square cross-section. *Aræopoma*, Lind.†, is intermediate between *Goniophyllum* and the normal cylindrical type of coral.

(b) *Calceola* trend.—The unusual form of the well-known Devonian coral *Calceola* is linked up to ordinary forms by numerous stages, and this trend is seen in Silurian as well as in Devonian stocks. Amongst Silurian corals, *Pycnactis rhizophylloides*, sp. n., *Holophragma calceolides* ‡, Lind., and *Rhizophyllum gothlandicum* §, Lind., progressively illustrate this trend.

## iii. Length of Septa.

The pinnate arrangement of the septa in the early stages of rugose corals is retained in maturity only in the more conservative types. One of two possible developments usually takes place, either the septa extend to the axis of the corallite and assume in the adult a quasi-radial symmetry (Cyathophylloid trend), or they may retreat towards the periphery and ultimately all but disappear (Amplexoid trend).

(a) *Cyathophylloid* trend.—*Pycnactis* retains the pinnate symmetry throughout all stages, but its derivatives, *Mesactis* and *Phaulactis*, develop from the pinnate to the quasi-radial.

(b) *Amplexoid* trend.—*Pycnactis* occasionally shows to some degree this development.

\* Lindström, Ofversigt af Kongl. Vetenskaps-Akademiens Handlingar, vol. xxii. for 1866, p. 287, and translation in Geol. Mag. 1866, pp. 356-362 and 406-414, pl. xiv.

† Lindström, 1883, Bihang till K. Svenska Vet.-Akad. Handlingar, Band vii. no. 4, p. 57.

‡ Lindström, 1896, Bihang Kongl. Svenska Vetenskaps-Akademiens Handlingar, vol. xxi. no. 7, pp. 4-50, pls. i.-viii. The species was also described as *Hallia calceolides* in the Geol. Mag. 1866, pp. 412-413, pl. xiv. figs. 19-23.

§ Lindström, 1866, op. cit. p. 287.



## EXPLANATION OF THE PLATES.

The letter R., followed by a number, indicates the register number of the section in the British Museum.

All figures are from camera-lucida or other drawings by the author.

## PLATE IX.

*Pycnactis*, gen. nov., and *Mesactis*, gen. nov.

*Figs. 1-7. Pycnactis mitratus* (Schl.). Wenlock Beds, Brinkmarsh Quarry, Whitfield, Gloucestershire. All figures  $\times 275$ .

*Figs. 1-4.* Transverse sections. Neanic stages. R. 25441-4.

*Figs. 5-7.* Transverse sections. Ephebic stages. R. 25445-6 and R. 25440.

Note the reduction in septal dilation at the axial edges and the irregular outline of the septa in ephebic stages, and union of adjoining septa at the more dilated parts.

*Fig. 8. Pycnactis rhizophylloides*, sp. n. Wenlock Beds, Island of Gothland. Corallite. R. 25447-8. The figure is a composite drawing of the two registered specimens, and illustrates the form peculiar to the species. Approx.  $\times 3$ .

*Figs. 9-18. Mesactis glevenensis*, sp. n. Wenlock Beds, Brinkmarsh Quarry, Whitfield, Gloucestershire. All figures  $\times 275$ .

*Figs. 9-15.* Transverse sections. Early neanic stages. R. 25449-55. Cf. *figs. 1-4, P. mitratus* (Schl.).

*Figs. 16-18.* Transverse sections. Late neanic stages. R. 25456-8.

## PLATE X.

*Mesactis*, gen. nov.

All figures  $\times 275$  diameters.

*Figs. 1-6. Mesactis glevenensis*, sp. n. Wenlock Beds, Brinkmarsh Quarry, Whitfield, Gloucestershire.

*Figs. 1, 2.* Transverse sections. Early ephebic stages. R. 25459-60.

*Figs. 3-6.* Transverse sections. Ephebic stages. R. 25461-4.

Note the diminution in septal dilation, as seen in progressively later stages, working inwards from the periphery, and the consequent development of dissepimental tissue.

## PLATE XI.

*Phaulactis*, gen. nov.

All figures  $\times 275$ , except figure 6, which is approximately  $1\cdot5$ .

*Figs. 1-6. Phaulactis cyathophylloides*, sp. n. Slite Group, Silurian. Västergarn, Island of Gothland.

*Figs. 1, 2.* Transverse sections. Late neanic stages. R. 25465-6. (Cf. Pl. IX. *figs. 1-4* and *figs. 9-15* for early neanic stages.)

- Figs. 3, 4.* Transverse sections. Ephebic stages. R. 25468-9. Note that in fig. 4 all trace of secondary thickening has disappeared except at the cardinal fossula.
- Fig. 5.* Longitudinal section. R. 25467. Cut from same specimen as figs. 1-4, segment between figs. 2 and 3. Note the corresponding parts affected by secondary thickening in transverse and longitudinal sections.
- Fig. 6.* Corallite from which figs. 1-5 were cut.
- Figs. 7-8.* *Phaulactis cambrensis*, sp. n. Wenlock Beds, Penylan, near Cardiff, Glamorganshire.
- Fig. 7.* Transverse section. Ephebic stage. R. 25471.
- Fig. 8.* Longitudinal section. R. 25472. Note that broad tabulæ and lesser development of dissepiments differentiate this from fig. 5.

## PLATE XII.

*Phaulactis*, gen. nov., and *Dinophyllum*, Lindström.

All figures  $\times 2.75$ , except figure 2, which is natural size, and figure 11, which is  $\times 1.5$ .

- Fig. 1.* *Phaulactis cyathophylloides*, sp. n. Slite Group, Silurian, Västergarn, Island of Gothland. Longitudinal section. R. 25470. Advanced stage.
- Figs. 2-6.* *Dinophyllum minimum*, sp. n. Wenlock Beds, Island of Gothland.
- Fig. 2.* Corallite, showing attachment-scar, on convex side. R. 25475.
- Figs. 3-5.* Transverse sections. Ephebic stage. R. 25473-4 (figs. 3-4). These sections show the grouping of the septa as described on p. 396, and the irregular outline of the columella; contrast this with fig. 9, with its distinct spindle-shaped columella and the union of the septa with it.
- Fig. 6.* Longitudinal section. R. 25480. Compare with fig. 10, and note less amount of secondary tissue and the widely spaced, highly inclined tabulæ.
- Figs. 7-11.* *Dinophyllum involutum*, Lindström. Wenlock Beds, Island of Gothland.
- Fig. 7.* Transverse section. R. 25476. Very early neanic stage, in which the septa tend to group as in late neanic and ephebic stages of *D. minimum*.
- Fig. 8.* Transverse section. Neanic stage. R. 25477. Later than fig. 7.
- Fig. 9.* Transverse section. Ephebic stage. R. 25479. Cut from same specimen as figs. 7-8 and 10.
- Fig. 10.* Longitudinal section. R. 25478. Cut between figs. 8 and 9. Note the excessive amount of secondary tissue and the more or less horizontal tabulæ.
- Fig. 11.* Corallite, showing calyx with columellar boss.

LV.—Notes from the Gatty Marine Laboratory, St. Andrews.  
—No. XLIX. By Prof. M'INTOSH, M.D., LL.D., D.Sc.,  
F.R.S., &c.

[Plates XIII.—XVII.]

1. On the Structure and Functions of the Operculum and Neighbouring Parts of *Mercierella enigmatica*, Fauvel, and other Serpulids.
2. On a new British Polychaet.
3. On a Larval Siphonophore (?) from the 'Challenger.'

1. *On the Structure and Functions of the Operculum and Neighbouring Parts of Mercierella enigmatica, Fauvel, and other Serpulids* \*.

The following is only a preliminary step in the study of the circulation in connection with the operculum of the Serpulids. Much remains to be done in the living forms, especially in those with more or less translucent organs. It is curious that recent authors —e.g., O. Mörch, MM. Caullery and Mesnil, Miss Busch, Fraulein Sterzinger, and others—do not enter on the structure of the interior of the operculum, and it is possible that the small rounded bodies shown in certain figures of the opercula may represent the rounded masses of blood and not ova seen through the transparent walls.

In the careful original description of *Mercierella* (Dec. 26, 1922) by Prof. Fauvel†, who had received specimens of this curious Serpulid from Prof. Mercier of Caen, no details of the structure of the operculum were given, and only a simple outline of the organ with its numerous distal spines was shown in the text-figures (Pl. XIII. figs. 1 & 2). In the diagnosis of the species, Prof. Fauvel observes.—“Opercule subconique, à base oblique légèrement concave et garnie d'épines chitineuses noirâtres, simples, légèrement incurvées vers l'intérieure et disposées sur plusieurs cercles concentriques.” Further, he states. “Cet opercule est membraneux et ne paraît renfermer aucune production calcaire. La concavité du disque operculaire est garnie de nombreuses épines chitineuses d'un brun foncé disposées sur plusieurs cercles concentriques. Ces épines sont simples, lisses, à point recourbée vers l'intérieur. Parfois, surtout chez les jeunes individus, il n'existe qu'un seul cercle de 15 à 20 épines.” Prof. Fauvel makes no further allusion to the structure of the organ, and in regard to distribution and reproduction of the Serpulid only observes: “Elle est sans doute venue fixée sur la carène d'un navire et ses œufs trouvant des conditions favorables se sont abondamment

\* I am indebted to the courtesy of Sir Sidney Harmer, Dr. Calman, and Mr. Carmichael Munro, of the British Museum, for various facilities, to Mr. Charles Major for several photographs and for information, and to Miss Harvey, of Edinburgh, Messrs. Gordon Cannon, Chas. Biddolph, London, Prof. Graham Kerr and Mr. Jamieson, Glasgow, and Prof. Stanley Gardiner and Mr. Buck, Cambridge, for sections.

† Bull. Soc. Zool. de France, t. xlvii. p. 424.

développés." No peculiarity of the interior of the operculum was mentioned, and in the figures a large number of small spines occur in circles on the distal surface of the organ.

I next had the opportunity of hearing Mr. C. Carmichael Munro, of the British Museum, give an account of what was supposed to be the same form as Prof. Fauvel's to the Linnean Society, and this was followed by his paper in the 'Annals and Magazine of Natural History' (ser. 9, vol. xiii. p. 155, January 1924). Mr. Munro's specimens were obtained at the London Docks, chiefly by the aid of Mr. Charles Major of the Red Lion and Three Cranes Wharf, whose excellent photographs of the living species *in situ* will again be alluded to. Mr. Munro describes the operculum (figs. C and D) "as formed from the dorsalmost filament of the left branchia . . . this is fig-shaped with its top hollowed out to form a shallow cup-shaped structure with a perfectly plain margin. Within and occasionally on this margin, which is without denticulations of any kind, there are a variable number of inwardly curved hooks arranged in a circular manner and which varied in number from 11 to 25, that most frequently occurring being 14." No allusion to reproduction or to the structure of the operculum is made.

Mr. Major's 70-foot barge, on which Mr. Munro's form was found, was coated with hot pitch on June 16th, 1923, was at the Red Lion Wharf on the 22nd and at the Royal Albert Dock on July 23rd. Six weeks of a Dock-strike kept the barge quiet. On August 21st a white band was noticed on the water-line. Then the barge was sent to Victoria Dock, thereafter making various trips, the white line meanwhile increasing much. On the 28th September the growth was photographed, and samples sent to the British Museum\*.

On comparing the figures of the operculum given by the two authors, the number of spines is far greater, as well as in size proportionally smaller, in the French than in the British specimens—a condition, perhaps, as Prof. Fauvel thinks, due to age†.

Mr. Munro kindly sent me some examples of the species in spirit, and glancing at the exterior of these I was at once struck by the fact (which the previous authors had not alluded to) that the operculum contained bodies which, viewed cursorily, somewhat resembled ova, and which were stated to be such in a brief note to the 'Annals' in July 1924‡, the appearance of the example being represented in the accompanying sketch (Pl. XIV. fig. 1). If the globular bodies shown by Irene Sterzinger§ in the elongated operculum of *Spirorbis foraminosus*, and on the shorter operculum

\* For this account I am indebted to Mr. Charles Major, and also for several photographs.

† Bull. Mus. Hist. Nat. Paris, 1925, No. 3, p. 238, fig. d.

‡ Op. cit. ser. 9, vol. xiv. p. 1.

§ Sitz.-bericht d. kais. Akad. d. Wiss. math.-nat. Klasse, Bd. cxviii. Ab. 1 (1909).

of *S. aggregatus*, were blood-masses, such would mimic the condition in *Mercierella*. They are not specially alluded to. It was put aside for further examination, especially of fresh specimens, but unfortunately none are now available on the barges in the London Docks.

Subsequently, Prof. Fauvel, surprised at the statement as to opercular development in the British examples, again took up the subject—this time examining sections of the operculum and showing that the peculiar bodies therein were not ova, as, indeed, was proved by Prof. Mercier's further information that *Mercierella* deposited its ova in the tube like certain other forms. He observed these yellowish masses—rounded or ovoid—roughly simulating ova which he had not previously noticed in the operculum. He gives a most interesting and most minute account of the structure of the operculum in both sexes—demonstrating that the yellowish bodies therein vary in size and number in the several examples. He thinks, from their appearances under stains, that they approach certain mucous masses and differ from fatty bodies. Moreover, he has found similar bodies in the operculum of *Hydroides*. He also describes the large ova in the tubes of *Mercierella*.

A closely allied form was described by E. Rioja\* in 1924 from Gandia in Spain, the author considering it to be the same species as Prof. Fauvel's, his paper being illustrated by text-figures and a finely coloured plate. This form was found in fresh or brackish water on stones, and was larger than that of Prof. Fauvel, and apparently with more vivid coloration of both branchiæ and body, the former being variegated throughout with numerous touches of a roseate hue. As it is with the operculum and its stalk that the present note mainly deals, the other features need not be detailed.

E. Rioja shows that in his examples the spines on the operculum are regularly arranged round its edge as well as scattered more or less in circles over its distal surface, these spines, moreover, having secondary spikes (1-3) projecting from the basal regions, whilst the hooked tips are sometimes bifid or trifid. Occasionally two hooks are connate. Moreover, the opercular stalk is broad distally and has two fillets running along its convex (ventral) border. These and other features would suggest to some specific distinction, but in such Serpulids (e.g., *Hydroides*, from the Cape) the variations in the armature of the operculum are even more striking. The additional spikes on the sides of the hooks of Rioja's form, indeed, recall the more complex organs in *Hydroides*. The author does not allude to the internal structure of the operculum. In his figure, moreover, the number of pigment-touches on the branchiæ are much more numerous than in the examples from the London Docks, the average number of these, as Mr. Munro also states, being 7, and they are larger and more prominent. In Prof. Fauvel's

\* Bull. R. Soc. Española Hist. Nat., Marzo 1924. I have to thank Mr. C. C. Munro for the loan of this paper.

figure these touches appear to be from 7 to 9, whereas in Rioja's figure 1 they are about double the number. Moreover, a feature of interest not hitherto emphasized is the tenuity of the terminal filament in the living animal (Pl. XIV. fig. 4), from a photograph taken by Mr. Charles Major, to whom I am indebted for the slide. Mr. Munro noticed that these "are sometimes longer and sometimes shorter than the pinnae," and Prof. Fauvel observes that they are variable. The figure, however, will show that their tenuity in life is noteworthy, and even Rioja's fine figure does not show them at full length. When fully extended they resemble slender threads with a slight enlargement at the tip. These structures are much finer and more delicate than those of *Crucigera zygophora*, Johnson, as shown by Miss Busch\*.

In re-examining the original specimen (Pl. XIV. fig. 1), the distal surface of the operculum is obscured by a mass of external growths and mud, the tips of the spines only appearing here and there. The operculum beneath is thin-walled, and when mounted in Farrant's solution is translucent, showing by transmitted light a series of dull yellowish rounded bodies, the minute structure of which in a clear example differs from that of ova, for neither nucleus nor nucleolus is present (*vide* Pl. XIII. figs. 5 & 6; Pl. XIV. fig. 1). The spherules are homogeneous, and vary in size and shape—each having a definite outline though no differentiated cell-wall is present, the mass apparently consisting of a more or less fluid substance (the mucus of Prof. Fauvel) which had escaped from a vessel. But the same substance appears in the dorsal blood-vessel, in the filaments and in the sinus surrounding the gut somewhat further back, so that it would seem to be the circulatory fluid of the animal, and this is confirmed by all subsequent observations.

Prof. Fauvel and Mr. Munro have drawn attention to the resemblance of the operculum of R. Southern's *Ficopomatus macrodon* from the Cochin backwater, near Ernakulam, on the S.W. shore of the Madras Presidency, to that in *Mercierella*, and the outline (Pl. XIII. fig. 3) is certainly close, though no spines are present. In the figure the distal surface is flattened, in others it is convex, but always smooth. Southern† observes that "the stem of the operculum is flattened and passes more or less abruptly into the swollen head, which is rather fig-shaped. There are no outgrowths either on the stem or the head of the operculum. Usually there are patches of pigment, a narrow band just beneath the swollen head being rather constant." No allusion to the interior of the organ is made. Major Sewell, I.M.S., Director of the Calcutta Museum, kindly sent me some tubes of *Ficopomatus* attached to a fragment of wood, but the glass tube, though carefully packed, had been broken in transit and the specimens so dried

\* Tubicolous Annel. from the Pacific, 1905, pl. xxix. fig. 5.

† "Fauna of the Chilka Lake" (Mem. Ind. Museum, vol. v. p. 656, pl. xxx. figs. 27 A & 27 C (1921).

as to be useless for minute work. Examination of a ruptured operculum soaked in Farrant's solution, however, demonstrated that large blood-spaces occurred in it as in all probability in many similar forms. A second consignment provided two opercula as well as that of another form from the brackish water of the above-mentioned region, and sections of these, for which I have to thank Prof. Graham Kerr, showed that the peduncle had a thick coating of hypoderm under the cuticle, but that it became thinner on the wall of the operculum and was especially thin distally. The centre of the peduncle contained fine reticulations, which as they approached the operculum became larger (proportionally larger than in *Mercuriella*), and in the operculum formed a similar series of delicate reticulations to those in *Mercierella*, and having similar masses of blood in the cavities (Pl. XV. fig. 3). The blood-vessel and a band of muscular fibres (on one side) were also present. Unfortunately, the preservation of the specimen was indifferent, but the coat of chitin on the distal region of the operculum did not seem to be thicker than in *Mercierella*. It is interesting that the diminution of the depth of the hypoderm on the operculum should be marked in both this and *Mercierella*, whose habitats are in brackish or fresh water.

In examining the second consignment of *Ficopomatus* from the Chilka Lake, kindly sent by Major Sewell, two opercula, separated from their pedicles, were observed, and which wholly differed from those of *Ficopomatus*. They probably pertained to tubes which were much harder than those of other species mentioned. They formed somewhat flattened triangles, the apex being at the pedicle and the base at the distal end, with the angles slightly projecting, whilst from the centre of the upper or free face a globular appendix projected, covered by the general chitinous investment (Pl. XV. fig. 4), so far as could be observed in the imperfectly preserved form; numerous blood-spaces occurred in the basal triangle and apparently also in the globular appendix, the reticulated structure of the interior of both parts corresponding with that seen in other forms. The junction between the basal triangle and the distal globule appeared to have no special apparatus, but fine reticulations occurred toward the pedicle. The examples, however, were indifferently preserved.

In *Mercierella* transverse section from the front or anterior end the operculum presents an external tough cuticle, beneath which is a layer of hypoderm on which the broad bases of the spines rest, the entire wall being comparatively thin, so that it readily collapses on pressure. The hypoderm passes into the interior of the chitinous spines, which appear to be cuticular (Pl. XIV. fig. 2). Passing backward the cavity of the organ enlarges and the rounded or ovoid masses of the blood increase in number and vary in size, some of the larger showing processes of their substance still attached, whilst in others portions of various sizes have separated wholly or partially. Moreover, the masses always have a smooth outline, and when a new mass breaks from another a definite outline

remains in the old with a blank internally, and this explains the smooth outline generally assumed by the masses. This definite outline would appear to be formed by the consolidation of the surface and not by a special cell-wall or sheath (Pl. XIII. figs. 5 & 6). The cavity of the operculum is traversed by delicate trabeculae—fine strands of tissue which slightly stain, and in the interstices of which the globules lie. This trabecular tissue appears to increase rather than diminish in the progress toward the stalk, the blood-masses here and there being bilobed as they separate, or even forming a series like an irregular roulette. Some masses, again, are lobed as if about to separate into several or be fused into a single mass. Moreover, in the trabecular tissue are various branched processes like blood-vessels and which take the same stain as the masses, and thus the origin of the latter is the more readily explained. The masses increase in size as the stalk is approached, the edges of some being crenated or folded, whilst others form long rolls like folded intestines. Towards its posterior or inferior end (next the stalk) the opercular wall, whilst it is no thicker, presents a better-defined inner edge, as if lined by a special membrane, though such could not be made out. As the stalk narrows the cavity is more or less blocked by the same masses as occur in the operculum. A projection at each side may represent ridges on the outer (dorsal) surface, but as the parts were ruptured this is uncertain. In some preparations little of the area of the operculum is free from the blood-masses, even more so than in the figure (p. 238, fig. *b*, and much more so than in the figure *a* on p. 240) \* of Professor Fauvel. No form yet examined presents such a remarkable collection of blood in this organ, and, moreover, it contrasts strongly with the condition in the peduncle.

Prof. Fauvel observes that "*La structure de l'opercule proprement dit diffère un peu de celle du pédoncule,*" but good longitudinal sections (Pl. XIII. fig. 6) demonstrate that, whilst the trabecular tissue of the peduncle forms smaller reticulations, those of the operculum proper are, as a rule, much larger, and apparently are so for a physiological purpose—viz., the reception of the blood, since no blood-vessel has been observed either by Prof. Fauvel or myself in the organ, whilst a large blood-channel occupies the centre of the peduncle. Some might be inclined to suppose that these spaces were pathological—caused by the rupture of the trabecular tissue before or at the death of the animal and due to the chemicals employed in preservation,—but the wall of the peduncle, as Prof. Fauvel also observes, thins off as it approaches the operculum, only the distal surface of which presents thicker portions at the rim and bases of the spines. The hypodermic tissue is especially thick at the base of the peduncle, thereby agreeing so far with the branchial filaments. The base of the peduncle, when severed across the hypodermic cells, presents a peculiar dotted aspect from the arrangement of the constituent cells.

\* Bull. Soc. Zool. de France (1925).



The diminution of the hypoderm of the operculum is most marked in the region of the large reticulations of the organ, though a thin layer of cuticle covers it externally and joins the chitinous bases of the spines. Prof. Fauvel observes:—"Sous cet epithelium" (our hypoderm) "règne une couche assez épaisse de fibres musculaires longitudinales," but that, "Au sommet du péduncule, sur un quart ou cinquième de sa hauteur, ces fibres longitudinales sont remplacées par un épais réseau de fibres circulaires." Good longitudinal sections, however, show that the longitudinal fibres proceed from the base considerably beyond (in one sense above) the commencement of the widely reticulated region of the operculum, though the circular muscular coat is certainly conspicuous and must exercise considerable contractile power over the mobile interior region. Both layers occur along the peduncle. The strong longitudinal fibres in longitudinal sections appear only on the convex side of the stalk, viz., that next the branchiæ, though at the base they almost fill the comparatively narrow central region, and probably join the muscular fibres from the branchial filaments, though this has not been seen. The circular muscular fibres form a conspicuous series from the greater part of the operculum to the base of the peduncle (Pl. XIII. fig. 6). The central blood-vessel usually presents the same contents as occur in the large spaces of the operculum, and it occupies, more or less, the central region of the opercular stalk.

In glancing along a longitudinal section of the operculum and the peduncle it is found that the interior, besides other structures, is occupied by reticulated tissue which at the base of the stalk forms a honeycomb-series of small spaces, and that these increase in size from the base upward (or forward) till the operculum is reached (Pl. XIII. fig. 6). The hypoderm of the peduncle is noteworthy for its great thickness, so that the contrast between that of the lower part of the stalk and that on the distal region of the operculum is pronounced. That organ is occupied by a series of thin-walled spaces, which are diagnostic and which could not have been suddenly formed by traumatic lesion from a ruptured blood-vessel. No shreds of the trabecular tissue with honeycomb-cells, as in the stalk, exist between the large rounded spaces throughout the operculum. It would appear therefore that the arrangement is special and probably in connection with blood-storage and with respiration, for the structure of the collar and branchiæ shows how active that function is in the region.

At the base of the peduncle the cuticle and hypoderm join those of the branchial filaments and those of the collar, the cephalic ganglia (*c.g.*) lying behind the intermediate space between the base of the peduncle and the branchiæ. Moreover, a group of eyespecks (blackish by transmitted light) lies on the upper or anterior aspect of the ganglia. In structure the ganglia show a complex series of fibres and cells, unipolar, bipolar, and tripolar cells being numerous, whilst the fibres form a complex throughout. At the origin of the large branchial nerve the cells are arranged on either

side. The ganglia are thus in immediate relationship with the most important organs in the life of the animal. Various reticulations forming perivisceral and blood-spaces occur in the region next the brain (Pl. XIII. fig. 6), and a section of the gullet occurs behind it. The whole region with the collar is largely supplied with blood, even the region of the collar-bristles, which form a curved double row in section, having blood spaces—probably from a vessel—internally.

The pale band, visible externally, near the distal surface of the operculum may be connected with the supposed circulatory function of the organ, though the chitinous cuticle is present.

In a series of sections of the operculum by Mr. Gordon Cannon of the Imperial College of Science, the cuticular coat of the operculum was coloured blue, but the spines were red—like the hypoderm,—even fragments of the base of the spines assuming this coloration, as if each differed in nature from the other. The hypoderm passes into the hollow of the spine and reaches nearly to the tip, only the chitinous investment of the spine being outside it. There is really no solid tip (Pl. XIV. fig. 2).

When the technique of so delicate an object as the operculum of *Mercierella* has been faulty, a good view of the masses of stained blood is sometimes obtained (Pl. XIII. fig. 5 and Pl. XIV. fig. 1), the trabecular tissue being very translucent, whilst the masses stand boldly out.

In agreement with the vascularity of the operculum, the branchial filaments have a large blood-channel, whilst the pinnules have a still larger (proportionally) vessel often distended with blood—indeed, in section the larger half of the pinnule is thus occupied (Pl. XIII. fig. 4) and its wall is thinner than that of the other half with its hypodermic thickening; but variations occur in the sections, some having hypoderm all round, others with the blood-channel so distended as almost to obliterate this layer. In a few pinnules cut longitudinally the contained blood is in rouleaux. In transverse section the filaments agree generally with the structure shown in *Hydroides* (Pl. XIV. fig. 7). though the central cavity extends further outward at each external angle so as to diminish the septum. Moreover, the fork at the tip of the septum cannot be made out. The folds from which the pinnules spring at the inner edge are similar. One feature, however, is conspicuous in *Mercierella*, viz., the pale nervous (?) area in the middle of the external hypodermic band, and this is probably supplied by the large trunk, which leaves the front of the cephalic ganglia in the direction of the branchiæ, a branch also passing to the opercular peduncle. The blood-vessels to these organs being formed by division of the main trunk in the same region.

In sections through the base of the branchiæ a median process juts forward in their midst, and it is pigmented on its anterior or free surface. Above it (*i.e.*, dorsally) is the central nervous system with the group of eye-specks. This median process may form a kind of upper lip or pad against which food-currents may

strike on their way to the mouth. Whether this median process represents a prostomium is an open question, but it would seem to be chiefly connected with alimentation and with the protection of the central nervous system.

In connection with the tendency of the blood in *Mercierella* and allied Serpulids to form isolated globules and rounded masses, the condition of the oral lobes is interesting, for in *Mercierella* (Pl. XVI. fig. 3) the blood in sections is arranged in a linear series of dots, which probably mark the course of the vessels supplying these structures; whilst in the section figured the edges of the oral lobes are free, such is not the actual state, since these folds join the tissues on either side of the basal branchial apparatus, the currents of the entire system probably being directed to the mouth, which has more or less a funnel-shape. In the same section the perivisceral and blood spaces near the cephalic ganglia are conspicuous, and the course of the vessels along the collar is also marked, whilst the collar anteriorly presents on its inner surface small ridges which adapt themselves to the grooves between the branchial filaments; posteriorly (as in the figure) such are absent.

The alimentary canal from the mouth inward has, under the two outer layers, a thick coating of cells which in vertical section are striated, but when seen from the inner surface are finely reticulated. The wall of the gullet seems to be more consistent (that is, denser) than the rest of the canal, but, so far as observed, it is not protrusible. In its progress backward this coat diminishes in depth, but by-and-by has the vascular sinus around it, the two conditions in all probability being closely related to each other. In longitudinal section the sinus is more or less regularly segmented and often presents a diameter exceeding that of the intestinal wall, thus contrasting with the massive wall of the gut anteriorly and its smaller vascular trunks. In the female the ova occur in numbers in the perivisceral space in the posterior part of the abdomen and sometimes extend far forward. In the male dense masses of sperms occupy the perivisceral space on each side of the intestine in the same region, and in longitudinal sections the curved lines of the dissepiments cut them segmentally.

In glancing generally at forms with capacious opercula the following observations may be made, though further study may largely increase our knowledge of the structure and functions of this interesting organ.

Forms like the *Serpula galeata* of Grube\*, with an acorn-shaped "glandiform" operculum, seem to be adapted both for protection and as a diverticulum for the circulating fluid.

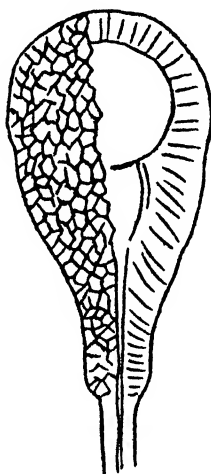
Schmarda† in 1861 described *Vermilia annulata*, from the coral reefs of Jamaica, as possessing an acorn-shaped smooth operculum with a concave distal surface surrounded by a horny

\* 'Ausflug nach Triest, &c.,' p. 151, pl. iv. fig. 9 (1861).

† 'Wirbellose Thiere,' ii. p. 28, Taf. xxi. fig. 176 (erroneously entered as 175).

rim. Ehlers and other authors have associated this form with such types as *Hyalopomatus*. No mention is made of the contents of the operculum, which is comparatively spacious.

Claparède\*, in describing *Eupomatus lenulifer* from Naples, specially alludes to the vascular plexus in the operculum, which he figures as an elegant urn of a greenish hue with a reddish opalescence. The vascular plexus forms, he says, a kind of glomerulus, and it has a somewhat triangular shape with the base distally. Moreover, he describes and figures a vascular twig passing along each of the spinous processes of the second or upper operculum. This author stated that a diverticulum of the coelom passed along the peduncle of the operculum, but is separated (in *S. laevis*) by a thick wall from the opercular brood-cavity, and he asks—Is this



Operculum of curious form from the 'Lightning' Expedition (Claparède).

diaphragm perforated by a central aperture or is it absorbed at periods†? His genus *Eupomatus* appears to be closely allied to *Hydroides*.

In Ehlers's‡ account of Claparède's study of the collection from the British 'Lightning' Expedition, a Serpulid having a straight calcareous tube is mentioned, but the animal in which differed from the generality of such forms in so far as the operculum was devoid of either horny or calcareous matter. In outline it is pyriform and presents a cavity superiorly filled with a brownish mass, due, he thought, to the rupture of the blood-vessel. Moreover, he shows five reticulations over the entire operculum, similar to those

\* Annel. Chétop. Nap. p. 441, pl. 31. fig. 3 (1868).

† Op. cit., Supplement, p. 159 (1870).

‡ Zeitsch. f. w. Zool. Bd. xxv. p. 9, Taf. 1, fig. 14 (1875).

indicated by Marenzeller in his *Hyalopomatus clapedii*. This cavity, he states, is in communication with the canal in the centre of the peduncle, and its walls are formed of the juxtaposition of a great number of transparent prisms, their bases forming on the surface of the operculum an elegant network. Such, therefore, would represent a form in which the blood in the operculum would specially be oxygenated (text-fig., p. 411).

The operculum of Grube's \* *Serpula chrysogyros*, from the Philippines, is somewhat similar, and it has a yellow band.

Prof. Haswell †, in 1884, noticed that in *Vermilia* the dorsal, opercular, and branchial trunks have relatively a thick layer of circular muscular fibres with a few elastic fibres. He also mentions that the greenish blood of the Serpulids stains readily with hæmatoxylin or carmine. He described and figured the ventral vessel anteriorly as ending in two divisions—each joining the main branchial trunk of its side.

Several of the species described by Langerhans ‡, from Madeira, such as *Hyalopomatus marenzelleri*, species of *Vermilia*, *Omphalopoma*, and others would afford interesting comparisons with the condition in *Mercierella*; and so with *Placostegus tricuspidatus*.

The globular operculum of *Apomatus elisabethæ*, McL. §, would appear to be less important as a protective organ (for it is small) than as a diverticulum in connection with the circulation.

An allied operculum is seen in the *Hyalopomatus langerhansi* of Ehlers || from Havanna, at a depth of 292 fathoms. The operculum has a long slender pedicle, and the soft organ itself is shaped like an elongated fig. Such would appear to subserve respiration as much as protection, for the interior appears to have lax cellular tissue.

The *Vermilia nigropileata* of Ehlers ¶ is an allied Serpulid from the Strait of Magellan, with a smooth operculum bluntly conical in shape and with a double ridge at the distal end of the pedicle. It is interesting that Ehlers noticed a brownish mass (blood ?) in the centre of the operculum, which had a thin chitinous investment. This species, moreover, has few branchial filaments, viz., 4 (including the opercular stalk) on each side.

Gravier \*\* describes from the French Antarctic Expedition a new Serpulid—*Helicosiphon biscæensis*—in which the operculum forms an inverted cone with a horny distal plate, beneath which he observed a transparent latticed region, which he thought calcareous

\* "Annulata Semperiana," Annelidenfauna der Philippinen, p. 276, Taf. xv. fig. 8 (1878).

† Proc. Linn. Soc. of N.S. Wales, 1884, sep. copy, pp. 1-27, pls. xxxi.-xxxv.

‡ Zeitsch. f. w. Zool. Bd. xl. p. 247, pls. xvi., xvii., etc. (1884).

§ 'Challenger' series, vol. xii. p. 514, pl. liv. fig. 4.

|| 'Florida Anneliden' (Mus. Comp. Anat. Harvard Coll.), p. 304, Taf. 60, figs. 10-15 (1887).

¶ 'Die Polychæten magellanischen und chilenischen Strandes,' 1901, p. 220, Taf. xxv. figs. 14-26.

\*\* Expéd. Antarctique, 1903-5, p. 64, pl. v. fig. 52 (1908-9).

and due to an excavation of the interior. Such in all probability was a dilatation in connection with the blood-system.

The elongated operculum of Willey's \* *Vermilia pygidialis* from the Ceylonese oyster-beds is devoid of spikes, though horny, and would appear to be less formed for closure of the tube than for other purposes.

A well-marked example of an operculum with thin walls and devoid of armature is seen in *Cystopomatus macintoshi* of Gravier †. This experienced author noticed that the distal surface presented a mosaic pattern, the microscopic reticulations being also observed on the sides, whilst in the centre an elongated mass was seen through the transparent wall. The peduncle was long and slender. In all probability the central mass alluded to by the author was blood.

What function the remarkable cylindrical operculum of *Vermilia annulata*, Schmarda, performs is unknown, but the area it affords for the circulatory fluid is proportionately large. Schmarda ‡ figures it as a long acorn, but Augener § gives it a cylindrical outline, a similar shape characterizing the operculum of *Spirorbis foraminosus*, Busch ||, from Japan.

Mrs. Goodrich ¶, in describing *Chitinopoma greenlandica*, mentions that a chitinous external investment surrounds both the branchial filaments—the operculum and its stalk,—yet that “the central cœlomic space in the pedicle is lined with peritoneum provided with very large conspicuous nuclei. There is a small vessel running along its whole length and enlarging in the opercular cup into a spherical vesicle. This is filled with a finely granular precipitate, and from its wall and general appearance seems to correspond with the branchial blood-vessels of the ordinary gill-rachises, though I do not see that it can have any respiratory function. It is apparently suspended in a fine reticulate connective tissue, which easily shrinks away from the epithelial cells; Levinsen in his original description suggested that it might be a new operculum forming in the old one.” The same writer's \*\* *Apomatus brownii* from a depth of 1410 fathoms has a transparent globular operculum, whilst her *Spirorbis antarcticus* from shallow water of the same Antarctic seas has an operculum not unlike that of *Mercierella* (except for the talon).

Marenzeller's †† *Hyalopomatus clapedii*, from a depth of

\* Rep. Pearl Oyster Fisheries, Supplem. Rep. xxx. p. 319, pl. vii. figs. 194–196 (1905).

† Deuxième Expéd. Antarctique Française, p. 149, pl. xi. figs. 146 & 147.

‡ Wirb. Thiere, pl. xv. fig. 176.

§ “Westindischen Polychæten,” Univ. Zool. Mus. Kopenhagen, xxxix. (1925).

|| Proc. Nat. So. Philad. vol. lvi. 1904, p. 176, text-fig. p. 177.

¶ Proceed. Zool. Soc. 1912, p. 791, pl. lxviii. fig. 6, etc.

\*\* Scott, Nat. Antarctic Exped. vol. vii., Zool. p. 89, etc. (1920).

†† Die Cœlent. Echinod. u. Würmer K. K. Öster-Hungar. Exped. p. 37, Taf. iv. fig. 2 (1877).

280 metres in the Austrian North Polar Expedition, has an operculum devoid of calcareous or horny matter, of the shape of an inverted cone, and which in the figure (2) is finely reticulated. Moreover, the author points out its close resemblance to the species described by Claparède. This author's *Serpula granulosa* has an acorn-shaped operculum of considerable capacity, the distal surface being either flat or hollow.

*Pomatocerus triqueter* (Pl. XV. fig. 5, Pl. XVII. fig. 1) is a form which specially frequents the region at or near low-water mark, but exposure is generally dangerous. Thus if in the search for whelks the stones in the pools and rivulets near low-water mark are turned over so that the tubes are left uppermost, and accordingly at a higher level, all die. It is interesting that in the Outer Hebrides this species is noted for the very hard and sharp spike which invariably guards the dorsal arch of the tube in front, and which inflicts deep wounds when the hard gneiss blocks are turned over. It is not a species which undergoes noteworthy changes in the salinity of the sea-water in which it dwells, and, therefore, structural changes in the operculum would not be expected. In mid-longitudinal section the operculum (Pl. XVII. fig. 1) has the shape of an inverted urn or cocked hat, and when the centre is approached an aperture leads from the stalk to the operculum, a series of small nucleated cells passing through as a streaked granular column from the one to the other. The wall of the operculum commences on each side of (that is, all round) the aperture with a thick layer of hypoderm, which gradually thins off in its progress distally, a thin layer occurring within the distal plate, except toward the centre, where the calcareous armature projects. There it somewhat increases in thickness. The parts, after treatment, and after section, have externally the remains of the calcareous process, which joins a thin layer outside the chitinous coat, but which terminates at its edge, the chitinous investment proceeding all over the organ toward the stalk. The calcareous layer thus lies outside the chitinous investment, and the question is as to its secretion. Is it secreted before the chitinous layer or after its formation? If after the formation of the chitinous layer, there is ground for supposing that the interchange between the contents of the operculum and its surroundings is not impossible.

On reaching the stalk this coat curves inward, leaving, however, the central aperture, the end of the plate in section being thickened and slightly curved forward. Apparently a channel runs round within the distal margin of the operculum (Pl. XVII. fig. 1), leaving in the section a well-formed ovoid space in the hypoderm, either with or without fibrous strands. Whether this is an actual channel or a space caused by the various manipulations is an open question, but it was constant in all the sections. The chitinous coat passes downward over the pedicle, at the base of which it thins off. The cavity of the operculum is occupied by delicate connective tissue with numerous minute nucleated cells scattered

throughout and with various large spaces, two being conspicuous in the middle line and others laterally. No blood appeared in the two examples sectioned. The nerve-centre has the same relation to the oral parts as in the previous forms, but the oral membrane is deeper than in *Mercierella*, and in consequence its longitudinal sections are considerably longer and apparently more slender. Moreover, the mucous cells which line it gradually increase in depth from the outer edge inward until at the junction with the canal they form long processes like fringes to the aperture.

The opercular peduncle has externally the translucent chitinous layer, within which is the hypodermic coat, the nuclei of the cells lying regularly a little within the bases. This coat in the preparations is thickest distally and on one side, but such probably is only the result of contraction, though it corresponds with the convex side of the peduncle. The interior of the stalk contains a fibro-granular stroma, like the operculum. When the section cuts the distal end of the peduncle outside the central aperture, the nuclei are arranged inside the chitinous layer in a regular series, without the attendant cells of the hypoderm. No eyes occur on the ganglia, which are deeply stained externally, whilst the central mass is pale.

The operculum in an example of what appeared to be the ordinary form of *Pomatocerus triqueter* from St. Andrews is lined by a hypoderm formed of very distinct cylindrical cells with nuclei as usual a little within the base (Pl. XV. fig. 5), and the layer is thick next the stalk, but diminishes in its upward course and at its distal plate. Moreover, whilst the operculum and its stalk are invested by a thin chitinous layer, it does not pass inward or fork as in the cases formerly described, but a massive development of the hypodermic coat occurs all round the median aperture, the coat thinning off as it goes upward to the terminal disc. The aperture is occupied by a streaked granular mass which projects into the operculum. As this was sectioned and mounted before the observation was made, it is not known whether the organ was in process of renewal. It did not seem to be a duplicate operculum, so that it suggests further investigation.

The opercular peduncle has externally the chitinous coat, beneath which is a thick layer of hypoderm of the usual structure, the centre being occupied by fine reticulations, the blood-vessel, muscular fibres, etc. When the hypoderm is cut across the cells it also assumes a finely reticulated appearance.

The centre of the operculum is occupied by nucleated strands of tissue, quite distinct from the well-defined cylindrical cells of the hypoderm, the trabecular tissue thus formed making the spaces in which the blood collects in the various preparations. The bases of the cells external to their nuclei are somewhat opaque, but they abut on the cuticular layer. No intermediate layer is present. This applies to all the forms examined.

The operculum in *Hydroides norvegica* (Pl. XV. fig. 1) presents the double tier and a much longer and proportionally narrower



pedicle. In longitudinal section the lower or fluted base presents from the edge inward the crenations and their chitinous investment, with the hypodermic layer below (Pl. XIV. fig. 5); then passing inward a central cup with two long lateral processes appears, the base of the cup within the cuticle and hypoderm being filled with connective tissue minutely reticulated so as to resemble minute cells, the basal region and the central area, however, showing larger reticulations as the sections proceed centrally, these larger spaces increasing in number as the base of the second tier of the operculum is reached. This is indicated by the extension of the chitinous cuticular coating from the first to the second tier, but the distal chitinous layer of the first is still continued beneath the connective tissue of the stout pedicle of the second tier. Reticulations occur in the central and distal regions of this pedicle, especially the distal—masses of blood occurring under the hypoderm. The distal chitinous sheath of the pedicle is much thicker than that covering the first tier, whilst the lateral investment is similar to that of the first tier. Moreover, as the centre is reached a gap or foramen in the chitinous distal layer of the first tier is observed, the edge being smoothly rounded (Pl. XV. fig. 1) and a short lip projects backward. The direction of this chitinous plate in section differs from that of the other species of *Hydroides* from Plymouth (Pl. XV. fig. 2), the lateral edge curving slightly backward and then straight onward to the central aperture and its lip. In the other species the chitinous plate curves forward at once from the outer edge, and forms a bold or high curve as it reaches the aperture. Through this aperture the blood enters to the second tier. The tissue of the pedicle, on the whole, is somewhat denser than that of the first tier, the central region being longitudinally streaked and having elongated blood-spaces. These spaces not only occur under the central region with its thick covering of chitin, but pass outward on each side in the sections of the chitinous plate from which the spines originate. Certain sections, indeed, of the central region show how vascular both tiers of the operculum are. The base or pillar of the distal tier has beneath the chitinous cuticle a layer of hypoderm, and its central region is curiously streaked, especially longitudinally, from the central aperture in the chitinous plate between it and the operculum below.

The first tier of the operculum has distally various large reticulations, enclosing considerable blood-spaces, but as it narrows to the pedicle the central reticulations are smaller, and the differentiation of the hypoderm as it reaches the operculum (from the stalk) does not appear to be so marked as in *Mercierella*. As the operculum narrows to the stalk the hypoderm forms a series of slanting lines on each side, at first with the small reticulations in the centre, but by-and-by these seem to meet, so that in a transverse section the aspect is that of an ellipse with a median line (Pl. XIV. fig. 6). It is difficult to say whether any of the oblique streaks of the operculum represent circular muscular fibres,





though such is possible. Whilst the central and distal regions of the operculum have large blood-spaces the outer part is occupied by small reticulations.

In transverse sections the stalk of the operculum presents a structure which diverges from that of a branchial filament, being somewhat elliptical in outline and bounded by the chitinous cuticle. A median line in the long diameter cuts the stalk into halves which slightly differ in appearance (Pl. XIV. fig. 6). On the left the hypoderm (the nuclei of which are external) of each end presents an accessory plume (*b*), whereas on the right such is not recognizable. Moreover, a blood-stain at *a* indicates the channel for the circulatory fluid.

Such a section diverges from that of a branchial filament (Pl. XIV. fig. 7), the hypoderm of which forms three areas, a median and two lateral, guarding an inner or central space in which lies the blood-vessel; whilst their margins are prolonged internally at the origin of the pinnules. Yet the relationship in structure is seen in the presence of the outer angles of the filament in section—for the septal band forks near the tip and forms a double termination as in the peduncle. The blood in the vessel of the filament is often arranged in rounded masses in section, just as the larger masses are in the operculum. Whilst the foregoing structure characterises the filaments, the pedicels present within the cuticle and hypoderm a central channel.

In certain superficial sections of the opercular stalk the lateral regions are occupied by a series of almost hexagonal cells, each with its nucleus, whereas the deeper sections present similar reticulations devoid of nuclei.

The other form of *Hydroides* from Plymouth differs considerably from the former, presenting two prominent ridges on the operculum which appear by-and-by to coalesce.

When the fluted region of the basal cup is cut transversely, each of the areas under the cuticular chitin has a circle of hypodermic nuclei and a central mass with slender processes radiating from it, the basal cup (first tier) is much smaller than in the previous form and has not the same symmetrical outline, the ridges on the pedicle near its junction also diverging. The area of the basal cup is much less than in the former species (*H. norvegica*). Though reticulated tissue occurs in various sections of the edge of the operculum no continuous canal is present. The basal process of the distal tier, moreover, rises only a little above the bottom (the apex of the triangle in section), the region below it having several large blood-spaces. The arrangement of the chitinous cuticle of the basal tier is similar to that in the foregoing form, and the aperture from it to the second tier occurs in the middle of the transverse septum and the rim projects backward as in the former case. In some the aperture appears to be proportionally larger, and the septum has a bold curve backward all around the median aperture (Pl. XV. fig. 2); indeed, the septum retains the peculiar curvature throughout. The blood similarly collects in spaces

below the hypoderm of the chitinous distal platform, and the most is made of the more limited area in each tier, the blood-spaces being proportionally large and numerous.

A longitudinal section (Pl. XV. fig. 2) in the line of the central aperture of the septum presents on each side the wall of the basal cup which gently diminishes from the inner to the outer edge, and is invested by the chitinous cuticle which in some appears to have a transparent parasitic growth with minute granules. The lax hypoderm with its nuclei occupies the interior (Pl. XV. fig. 2) with the exception of the centre, which has a deeply-stained fibrous strand originating in the centre of the pedicle. The centre of the operculum is occupied by trabecular tissue—probably closely connected with the hypoderm, for there is no distinct differentiation and it is crowded with nuclei, especially in the centre. The large blood-spaces are conspicuous and lie in the V formed by the dark fibrous layer just alluded to. The sides of the aperture in the septum show longitudinal streaks with nuclei. The basal pillar of the second tier has various smaller blood-spaces in its nucleated trabecular tissue, which is denser externally. The distal surface has, as in the former *Hydroides*, a thicker chitinous layer in connection with the spinous processes, and blood would appear to pass along some distance within the hypodermic lining of the chitin on each side of the section. When the section is on one side of the middle line (Pl. XVI. fig. 4) a continuous chitinous diaphragm is shown, and the large blood-spaces are conspicuous, though the general area is reduced. It is evident that the most is made of the restricted area, as compared with the operculum of *H. norvegica*.

Entangled in both forms of *Hydroides* in the muddy debris in the hollows of the tiers are foraminifera, radiolarians, diatoms, and other minute structures, which indicate the surroundings of the Serpulids, and no doubt largely form the food which the ciliated branchiæ direct towards the mouth.

The operculum in *Serpula vermicularis* forms a fluted inverted cone covered by the chitinous cuticular layer resting on the hypoderm, and filled throughout by the trabecular or connective tissue, which, however, forms smaller reticulations than in *Hydroides*. No large blood-spaces, indeed, are met with in a whole series of sections of the organ, but the smaller are numerous, the blood in some cases assuming a granular character in preservation. The absence of the large spaces gives the interior of the operculum an uniformity not usually seen, the reticulations forming a series of small spaces like cells except in the case of the somewhat larger ones occupied by the blood. No trace of a marginal canal occurs in this species. The hypoderm is thick, but merges into the reticulated tissue both in the operculum and its pedicle without much differentiation, though such is evident enough where the longitudinal muscular fibres pass. The sides of the operculum (forming the wings in longitudinal section) show the same cellular aspect from the reticulations inside the hypoderm, and a few blood-spaces occur in these, chiefly at the base. On the whole, the number of the blood-spaces in the centre of the operculum make

up for the larger ones in *Hydroides* and *Mercierella*. The distal face of the operculum presents various ridges and grooves.

The peduncle has the typical structure (Pl. XLV. fig. 8) with its central blood-vessel and surrounding reticulations, and the external hypoderm and cuticle, but the arrangement is different from that in *Hydroides*. Thus, whilst the shape in transverse section is ovoid, no median septal line is present, the hypoderm, the nuclei of which are external, surrounds a more or less central reticulated space in which the blood-channel occurs.

In *Spirorbis borealis*, Daud., the pinnules of the filaments are richly ciliated, and the bluish-green current can be observed passing along the side of each to the tip, but apparently only one vessel is present, so that the current must flow outward and return in the same channel. No cilia are seen on the collar or the opercular apparatus, the latter being brownish by transmitted light and the central region opaque. The organ is proportionally large, like a broad spatula, and with a short wide stalk. As compared with the ordinary Serpulids the operculum is larger and the stalk shorter and wider. Viewed from the exterior the calcareous and circular terminal disc appears to have a small pale spot in the centre like an aperture, and in lateral view the operculum presents a streaked aspect, apparently from muscular fibres in the centre, whilst the hypodermic wall is thick. When seen laterally, the stalk and operculum resemble a leg and foot - from the oblique position of the terminal disc. By transmitted light the operculum presents somewhat fine reticulations—few of which contain blood in the preparations.

Cilia are active on the body anteriorly, and they are shorter than those on the branchial pinnules.

In one a stellate group (motionless) of what might be spermatozoa occurred on the 30th March outside the ruptured body. No ova have been seen. The examples attached to *Membranipora* seem always to be dead.

Unfortunately, only a single example of *Spirorbis borealis* was available in the sections, and the operculum had been ruptured in the manipulations. As far as could be observed, the structure of the operculum agreed with that already detailed for the other forms, the cuticular coat having beneath it a thick layer of hypoderm with proportionally large cells, the nuclei of which lay close to the cuticle, the width of the cells large, and their inner ends well defined—that is, they were not extended into the reticulated central region as Løye shows. Blood-masses occurred, but the rupture of the organ negatived definition. The opercular peduncle presented the thick hypodermic layer under the cuticle and a boldly reticulated aspect when obliquely cut.

Pagenstecher\*, Alex Agassiz†, Fewkes‡, Caullery and Mesnil§,

\* Zeit. w. Zool. Bd. xi. pp. 486-495, Taf. 38 & 39.

† Ann. Lyceum Nat. Hist. vol. viii. pp. 318-323.

‡ American Natural. 1885, p. 247.

§ Bull. Fr. Belg. t. xxx. pp. 185-233, pls. vii.-x., and C. R. Acad. Sc. Paris, cxliv. p. 48.

Schively\*, and Loyer† are amongst the authors who have dealt specially with the Spirorbids, yet few of these—indeed, only Loyer—have gone into the minute structure of the operculum in the group. He observes in *Spirorbis borealis* that the operculum presents under the chitinous cuticle, which is thicker than on the branchia, a layer of cylindrical epithelium (the hypoderm of the author), which is thinner under the distal region—where the chitinous coat is thicker beneath the calcareous plate. In Taf. 18, fig. 26, he gives a section of the organ in which underneath the cuticle is a granular layer distinct from the hypoderm which follows, and the long cells of which stretch to the centre of the organ, which has a distinct wall enclosing muscle-fibres scattered all round the blood-vessel in the centre, whilst a nerve lies on each side at the wall. This figure is somewhat diagrammatic, especially as regards the continuity of the hypodermic cells with the supposed boundary-wall of the central cavity and the distribution of the muscular fibres. Moreover, in the adjoining figures of a longitudinal and a transverse section of the branchia the muscular fibres lie on one side, whilst the hypodermic cells reach the cuticle, though, on the whole, rather diagrammatically. His finding an abnormal operculum (Taf. 16, fig. 15) with five large openings with definite edges was remarkable. Loyer's contribution to the structure of the Spirorbids, however, is a notable one.

The structure of the operculum in the various forms appears to be associated with a double function, viz., with protection and with the circulation and, in addition, it may be with respiration. Morphologically the operculum and its stalk correspond to a modified branchial filament, the pinnules even remaining on it in certain forms, such as *Apomatus similis*, Marion & Bobretzky‡, yet in such as *Mercierella* the minute structure of the organ diverges considerably, as shown either in transverse or longitudinal section, and that structure probably is associated with a special function. In almost all those examined the lax tissue of the operculum affords a special receptacle for the blood either in the expanded or contracted condition of the parts. When the delicate branchial filaments are withdrawn into the tube the operculum would form an additional receptacle for the circulating fluid in all cases, and especially in such forms as *Mercierella* and *Ficopomatus*, in brackish or fresh water. Whether the blood can be acted on under the circumstances is an open question, but in *Mercierella* and *Ficopomatus* the thinning of the coats of the organ in contrast with the stalk would lend weight to such a supposition. Since the circulation in the operculum and its stalk is incomplete, viz., that the same channel which carries it to the organs returns it, the presence of the blood-spaces is an important factor. In this connection the occurrence of small perforations in

\* Proc. Nat. Sci. Philad. p. 153, pla. i., ii.

† Zool. Jahrb. Bd. xxvi. p. 805, Taf. 16-18 (1908).

‡ Ann. Sci. Nat. 6e sér., t. ii. (1875).

the calcareous plate of Mrs. Goodrich's \* *Spirorbis antarcticus*—through which membranous projections protrude, is interesting. Further, the fact that the calcareous plate of the operculum appears to be formed outside the chitinous layer is important.

How far a fresh-water habitat in such as *Mercierella* is connected with the great development of the opercular blood-spaces is also an open question. The arrangement certainly occurs in marine as well as in these, though the development is less pronounced.

In such forms as *Hydroides* the double and complex tiers of the operculum engender collections of plankton—various living and dead Protozoa occurring amongst the mud. The ciliary currents of the oral region probably carry much of this into the mouth.

## 2. On a new British Polychæt.

### *Amœa collei*.

The fragmentary and injured example was collected near Port Erin, Isle of Man, by Prof. F. J. Cole of Reading University, and he kindly forwarded it to me.

Though only the softened anterior end of five or six segments is present, it is closely allied to *Amœa*. It differs, however, from the single species originally described by the elder Sars and later by Malmgren, while agreeing in general with the genus. Thus the oral fold forms dorsally (Pl. XVI. fig. 2) a deep frill, which curves ventrally on each side to form two parallel flaps, which curve outward in front of the first segment to form on each side a large flap beset with numerous slender tentacles as in the type. The edge of the anterior fold, again, carries larger tentacles, both sets being grooved. The continuation of the anterior into the lateral flaps appears to differ, as far as description and figures go, from *A. trilobata*, which further shows on the ventral surface a median tongue-like process. Again, the anterior edge of the dorsal collar appears to be smooth in the Norwegian species, the larger tentacles arising at its base, an essential divergence when contrasted with the British form. Malmgren represents a simple transverse segment behind the lateral lamellæ with the small tentacles, whereas the British form presents dorsally a thick curved ridge opposite these lamellæ and a thick angular ridge some segments behind, the whole giving a special facies to the region. Nothing of the kind occurs in *A. trilobata*. The posterior angular ridge may result from injury and softening before preservation, but it lends a shield-like character to the region, which has a median longitudinal furrow in front and four transverse sulci behind. The ventral surface (Pl. XVI. fig. 1), unfortunately, is much injured; but, so far as can be seen, only a broad furrow passes from the oral groove backward, whereas in *A. trilobata* a long acute triangle in front has five scutes in the middle line depressed below the surface. Whether any such structures occurred in the British

\* "Polychæta, S.Y. 'Sootia,'" vol. vii. p. 91, pl. fig. 3.



form is unknown, for the whole surface is destroyed, but the facies seems to diverge.

The anterior bristles consist of glistening tufts of simple tapering forms devoid of wings, and forming a fascicle ranging from the shorter to the longer.

The fact that only a fragment of the anterior region is available prevents the determination of the exact position of the specimen. For, as Gravier\* has pointed out, the allied genus *Anisocirrus* has an anterior region devoid of hooks as in *Amœa*, but has avicular hooks in the posterior region, whereas *Amœa* has aciculi-form hooks in the latter—a distinction of considerable importance,—though the expanded collar in *Anisocirrus* approaches the conditions in *Amœa*, since the larger tentacles are chiefly anterior and central, the smaller on the lateral wings. *Anisocirrus* was dredged in water 15 to 20 metres in depth in the Bay of Djibouti in the Red Sea. It is curious that in the numerous Zetlandic dredgings of Dr. Gwyn Jeffreys and Dr. Merle Norman *Amœa* was never obtained.

### 3. On a Larval Siphonophore (?) from the 'Challenger.'

An enigmatical body (Pl. XVII. fig. 2), resembling in outline a Cœlenterate, was trawled at 1850 fathoms on a bottom of *Globigerina* ooze, along with the striking *Buskiella abyssorum* and *Lagisca mosleyi*, by H.M.S. 'Challenger,' at Station 106 in the mid-Atlantic, lat. 1° 47' N., long. 24° 26' W., east of St. Paul's rocks. Amidst the débris accompanying the former a minute structure, little more than a millimetre in long diameter, was observed—shaped like a polyp, with a series of lobate bodies attached and resembling a complex yolk-mass. It may, of course, have been captured in mid-water or near the surface as the trawl came up. Mounted and put aside it remained forgotten till now.

The basal structure is globular (Pl. XVII. fig. 2), smoothly rounded, and presents on one side five tapering processes or tentacles, those on the opposite side apparently being folded and indistinct, the tips of two appearing over a bulbous mass at the base of the five already mentioned. Attached to the anterior end is a series of rounded bodies like yolk-masses, and apparently solid, a high power revealing only a minutely granular structure with a smooth investing membrane, thus differing in minute structure from the body and arms. The rounded body presents under a delicate investing membrane a coating of short spine-like processes, best seen on the free edge, and which cover the entire surface forward to the lobate region, and a similar structure characterises the tentacles even to their tips (Pl. XVII. fig. 3). The spinous structure of the body and arms differs from that of an ordinary Cœlenterate, and the question arises as to whether it may not have been introduced from the ship itself. The view of Capt. Tatton,

\* Nouvelles Archives du Muséum d'Hist. Nat. 4e sér. t. viii. p. 231, pl. v. figs. 239-242 (1906).

of the British Museum, who kindly examined it, is that there is reason for thinking it a Hydrozoan, though not a Siphonophore, and that it might be described as an actinula-like organism with external gonophores, but it is difficult to guess at its exact nature.

## EXPLANATION OF THE PLATES.

## PLATE XIII.

- Figs. 1 & 2.** The operculum of *Mercierella enigmatica* as originally figured by Prof. Fauvel.
- Fig. 3.** Operculum of *Ficopomatus macrodon* as figured by Mr. Southern.
- Fig. 4.** Transverse section of a pinnule of *Mercierella enigmatica*.
- Fig. 5.** Longitudinal section of the operculum of the foregoing, in which are various blood-masses.  $\times 250$  diam.
- Fig. 6.** Longitudinal section of another example in which the operculum has been somewhat altered by pressure, but which shows the large reticulations of the operculum and the smaller reticulations of the peduncle with the perivisceral spaces and the cephalic ganglia (cg) at its base. Enlarged.

## PLATE XIV.

- Fig. 1.** The original specimen of *Mercierella* from the British Museum, having the operculum more or less covered with growths—viewed from the exterior. The opaque masses of blood resembled ova.  $\times 50$  diam.
- Fig. 2.** Spine from the operculum of the same showing the hypodermic lining and the hollow nature of the chitinous investment.  $\times 250$  diam.
- Fig. 3.** Transverse section of the opercular pedicle of *Serpula vermicularis*, L., having the chitinous cuticle externally, a thick layer of hypoderm trending toward the central region.  $\times 55$  diam.
- Fig. 4.** The operculum and branches of *Mercierella enigmatica*, Fauvel, from a photograph taken in life by Mr. Charles Major. The tenuity of the terminal process of each filament is demonstrated. Enlarged.
- Fig. 5.** An outer longitudinal section of the operculum of *Serpula vermicularis*, L., showing the hypodermic tissue.
- Fig. 6.** Transverse section of the opercular pedicle of *Hydroides norvegica*, Gunn., showing the median septum and the curious fork at each end of it. The central blood-vessel is indicated.  $\times 60$  diam.
- Fig. 7.** Transverse section of a branchial filament of the same, in which the septa present a similar arrangement at the outer end. The blood-vessel and the bases of the pinnules are also shown.  $\times 350$  diam.

## PLATE XV.

- Fig. 1.** Longitudinal section of the opercular tiers of *Hydroides norvegica*, showing the chitinous septum with its finished central aperture between the two, with indications of the blood-spaces in both.  $\times 50$  diam.
- Fig. 2.** A similar section of another form of *Hydroides* from Plymouth. The curves of the chitinous septum with its central aperture, the blood-spaces, as well as the proportions of the parts differ.  $\times 50$  diam.
- Fig. 3.** Operculum of *Ficopomatus macrodon*, Southern, in longitudinal section, showing numerous blood-spaces and somewhat coarse reticulations of the pedicle. The hypoderm becomes thinner as it envelops the operculum. The specimens were imperfectly preserved and had been detached from the Serpulids.  $\times 50$  diam.
- Fig. 4.** Outline of an operculum accompanying the former from the Chilka Lake, with a globular mass attached to the centre of the flattened organ.

- Fig. 5. Part of the operculum and its pedicle in an example of *Pomatocerus triqueter*, L., from St. Andrews, in which the chitinous investment did not form a diaphragm between the two.  $\times 60$  diam.

## PLATE XVI.

- Fig. 1. The new British Polychæst (*Amœa colæi*) from the Irish Sea—viewed from the ventral aspect. Enlarged.  
 Fig. 2. The same from the dorsal(?) aspect. Enlarged.  
 Fig. 3. Longitudinal section of *Mercierella enigmatica* through the collar-region, showing the oral funnel (a), perivisceral spaces, and part of the ganglia.  
 Fig. 4. Longitudinal section of the opercular tiers of the second form of *Hydroides*, from Plymouth (Pl. XV. fig. 2), removed from the middle line and showing the blood-spaces, continuous chitinous diaphragm, and other features of the region.  $\times 60$  diam.

## PLATE XVII.

- Fig. 1. Longitudinal section of the operculum and part of the peduncle of *Pomatocerus triqueter*, L., in which the usual aperture of the chitinous diaphragm is present. The hypoderm becomes thinner as it proceeds toward the distal region of the operculum.  $\times 55$  diam.  
 Fig. 2. Enigmatical Cœlenterate (?), thought by Capt. Tatton, of the British Museum, who kindly examined it, to be a Physophoran Siphonophore.  $\times 50$  diam.  
 Fig. 3. Tip of one of the processes of the foregoing.  $\times 350$  diam.

LVI.—*Ancestrula of Cheilostomatous Bryozoa.*—Part V.  
 Cupularia &c. By ARTHUR WM. WATERS, F.L.S., F.G.S.,

[Plate XVIII.]

## SHORTENED references :—

Waters, "The Relationship of the (Bryozoa) ('Selenariadæ') *Conescharrellina* &c.," Journ. Linn. Soc., Zool. vol. xxxiv. 1921.

Canu and Bassler, North American (Later Tertiary) Bryozoa, 1923.

Now that some attention has been given to the ancestrula of various Cheilostomata, it seemed that a study of the ancestrulæ of the *Cupularia* group might give us some assistance in understanding that puzzling section, and points of interest have been found, among other things the double ancestrula of *Cupularia canariensis*, &c.

I wrote a paper on the "Relationship of Selenariadæ, Conescharrellinidæ, &c."\*, about the same time that Canu and Bassler published their results, so that neither of us was

\* Journ. Linn. Soc., Zool. vol. xxxiv. 1921, following one on "Batopora," Ann. & Mag. Nat. Hist. ser. 7, vol. iii. 1919.

aware of the conclusions of the other. Naturally, if I had written after a study of Canu and Bassler's work, there are a few things, especially those relating to the central zoëcia, which I might have expressed differently, but no vital point would have been altered. The value was shown of various characters, not only in what had been known as the upper surface, but also of the under surface. What we have called the upper surface is, in the ancestrular and early stages, at the top, even though there may be a subsequent reversal, which makes it puzzling to speak of upper and lower, so that it seems better to say frontal and dorsal; nor is Canu and Bassler's "exterior" and "interior" or inner a fortunate expression.

At that time I approached the subject with a quite open

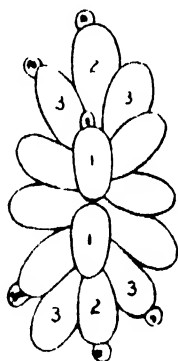


Diagram of ancestrula of *Cupularia*.

mind, and was quite prepared to find conical growth in various species, having little else in common, whereas my results showed, by examination of zoëcial characters, fairly close connection in various respects. The growth of some closed central zoëcia was mentioned, but my studies of the ancestrula necessitate my returning to the subject. We have known that there are many cases where the central zoëcia are closed and without an oral aperture; they are usually minute and shallow, and do not seem to contain a polypide, and it is puzzling that these imperfect zoëcia should produce perfect ones. The converse of closed zoëcia being produced from perfect ones does not present as big a problem.

These closed central zoëcia occur in *Cupularia*, *Selenaria*,

and *Lunulites* \*, but *Cupularia canariensis* has a double mary, the two ancestrulæ being turned in opposite directions (see Pl. XVIII. fig. 10, and text-fig.), and from each there are three distal zoœcia, similar to those found so generally † at the distal end of the ancestrula. The same double primary occurs in *Vibracellina simplex* ‡, Canu & Bassler, also in *Vibracellina capillaria*, C. & B. §, of which Canu and Bassler, speaking of two small equal zoœcia, say, "which of these is the ancestrula cannot be discerned." Attention has been called to double primaries in *Membranipora villosa*, Hincks, and *M. villosa*, var., Waters; and also in *Flustra hispida*, Fab. Canu and Bassler say of *Vibracellina*, "endozoœcial ovicell which is a distal convexity." I do not see this in their figures and it looks like *Cupularia*. No doubt, appreciating these cases of double ancestrula will help to unravel some of the difficulties in discerning the ancestrula. In my paper on *Selenariadæ* &c., the double ancestrula is partially figured (pl. xxx. fig. 11), though at the time it was not recognized as such. It has now, however, been seen in many specimens of *Cupularia canariensis*, but not in *C. denticulata*, nor in *Selenaria* or *Lunulites*. Gabb and Horn may have meant to describe a double ancestrula in *Heteractis duclosii*, but the description is not clear.

*Cupularia canariensis* shows another peculiarity in specimens from Princess Charlotte Bay, N.E. Australia, for following after the ancestrula and the immediately surrounding zoœcia there are others only partially closed and they can be studied through the membrane, and here the calcareous wall has round the border some large pores as in *C. umbellata*, with a few small pores or openings on the frontal (fig. 10). There is in these specimens a considerable variety in these semi-closed zoœcia, but the characters of *umbellata* can be seen in a fair proportion of cases. The smaller openings on the frontal are not round pores, such as occur frequently in the Cheilostomata, but irregular openings as if caused where there is a junction of the growing walls; sometimes there are spinous processes from the frontal side wall as in *C. denticulata*. The close relationship between *C. canariensis* and *C. umbellata* through *denticulata* is thus shown (see Pl. XVIII. figs. 1, 2, 3).

\* *Lunularia vicksborgensis*, C. & B. (Early Tert.), pl. lxxxiii. fig. 4, and *Rectonychocella tenuis*, C. & B., id. pl. xxxiii. fig. 6, have ancestrula similar to the ordinary zoœcia.

† (*M. pilosa*), p. 599.

‡ (Later Tert.), p. 35, pl. x. fig. 6.

§ (Early Tert.), p. 110, pl. xvi. fig. 16.

*Cupularia denticulata*, var. *multispinata*, C. & B., has no double ancestrula (Pl. XVIII. fig. 4) in my specimens nor has *Selenaria* (a genus named *Otionella* by Canu and Bassler). Some central zoœcia of *Selenaria* are closed, and the ancestrula has the same shape as the mature zoœcia, see *C. johnsoni*\* (B.), Waters †, and these characters occur in *Selenaria concinna*, T. Woods, and *Setosellina roulei*, Calvet ‡.

In *Selenaria* the ancestrula and the neighbouring zoœcia have an oral aperture like that of the ordinary zoœcia, which, however, is often partly closed by what has been called a tongue, but from the growth in *C. canariensis* and further specimens I have considerable doubt as to whether we were right in our interpretation, for it now seems to me possible that this may indicate part of the closure being gradually removed from the sides until the aperture is entirely free. Similar tongues occur in *Lunulites* §.

The zoaria of *Cupularia*, *Selenaria*, *Lunulites*, and *Vibracellina*, as we have long known, mostly originate on small stones or pieces of shell, with closed zoœcia, then they grow into more or less conical zoaria, and it has been suggested that they afterwards mostly float with the ancestrular region underneath, but this will be impossible when the larva settles upon a relatively large and heavy stone.

In *Cupularia* the species seem closely allied, for beginning with *C. canariensis* the front is open with the side walls sloping inwards to the opesia opening and the operculum is in the frontal membrane; in *C. denticulata* (fig. 2) the zoœcial shape is quite similar, but there are denticles or denticular processes starting from the lateral walls, *C. umbellata* (fig. 3) has the same zoœcial shape, but there is a calcareous front wall, with a few large pores round the border, and small irregular openings in the calcareous wall, though not round pores as we usually find in Cheilostomata. Each of these has a closely corresponding distal vibraculum, and this is an important character in *Selenaria* = *Otionella* ||, C. & B., occurring distally to the vibracular chamber. The vibraculum of *Setosella* and *Setosellina*, also growing on

\* Madeiran Polyzoa, pl. xxiii. fig. 3.

† Waters (*Selenariadæ*), pl. xxx. fig. 11.

‡ (*Ancestrula*), pt. ii. pl. xxi. fig. 4.

§ (Early Tert.), *Lunulites ligulata*, pl. xiii. fig. 10.

|| *Otionella*, C. & B., seems hardly separable from *Selenaria*, even though Canu and Bassler consider *Otionella* to be *Anasca Malucostega*, while *Selenaria* the, place in *Coelostega*, p. 109. The vibracular front wall of the vibracular chamber is very often broken away in recent specimens.

small stones, is the same as in *Cupularia*, but the ovicells, ancestrula, and frontal show sufficient difference to place them in another genus.

In *Conescharellina* there is considerable calcareous overgrowth, so that the ancestrula is deeply buried, see (*Selenariidæ*), pl. xxix. fig. 16, and (*Batopora*), pl. vi. fig. 8; it is thus almost impossible to obtain detail acquaintance with the ancestrula.

Canu and Bassler speak of the central closed zoecia as being hydrostatic and radicular, and seem to think this is sufficient explanation. I do not want to discuss, or still less to question, this until it is better understood, for we have not been told or figures given showing how these hydrostatic zoecia function, and an explanation from recent specimens is much wanted. How is it that closed zoecia occur in such diverse genera, see specially *Membranipora*, *Rosseliana*, *Membrenodæcium*?

In many species of these groups the zoecial chambers are not closely touching, but are attached to their neighbours by fairly long tubes, instead of communicating directly through rosette-plates. The tubes are shown in fossils by Beissel\*, and I have shown them in specimens from Madeira, sent to me as *C. lowei*, Busk †, and perhaps it is here that we must look for an explanation, as it is not yet clear.

Canu and Bassler ‡ give the following account of the zoarial hydrostatic system:—"The larva ordinarily attaches itself firmly on a grain of sand. The ancestrula which is derived from it immediately gives rise to some closed hydrostatic zoecia, which by their lightness permit the zoarium to commence its growth by ascending away from the sand dangerous to its development. When in the vicinity of algæ, the zoarium remains fixed under their fronds. When they do not offer sufficient shelter, the closed zoecia transform themselves into perforated, calcified zoecia, which are radicular; the radicles then attach the zoarium to shells, stones, or small algæ. The zoarium continues to develop in a more or less widened cone and always with the apex below. The zoarium increases or diminishes its volume by aid of parietal muscles attached to the ectocyst; it also increases

\* "Ueber die Bryozoen der Aachner Kreidebildung," Nat. Verh. Hollandsche Maatsch. der Wet., vol. xxii. 1865. *Lunulites goldfussi*, Hux. pl. ii. fig. 25; *L. hagenovi*, fig. 30; *L. cretacea*, pl. iii. fig. 84; *Pavonulites elegans*, B., fig. 38; *P. costata*, d'Orb., pl. iv. fig. 42; *Semischara crassa*, B., pl. iv. fig. 50.

† (*Selenariadæ*), pl. xxx. fig. 2.

‡ (Early Tert.), p. 288.

its volume by the development of tuberosities on its non-celluliferous face or by special tubercles on the same face. This organization, infinitely varied in detail, permits the animal to be assured of its existence under a rather constant depth of water and to avoid the great strain of hydrostatic pressure." Figures might explain this.

Canu and Bassler say \*: "It is a recognized fact that these *Lunulites* forms of growth are only the adaptation to a particular mode of existence in sandy facies," an opinion also held by Harmer, and at one time, in part, by myself, but my examination of a number of species has led me partly to question the conclusion that the cupulate forms represent a large number of scattered known genera. In fact, I am not unprepared to see such forms, with distinct characters on both faces, placed in a new suborder.

Besides the general zoarial cupulate shape, I showed that there are a number of large chambers under the frontal in *Cupularia*, and also in *Conescharellina* though differently shaped, and besides there are several characters on each face which can be used in classification.

*Conescharellina*, though showing some affinities, is not so closely related as the species already considered, but must belong to the group; it has, however, frontal avicularia placed radially, and an operculum fitting into the oral aperture (the dorsal surface is with or without avicularia), consequently † I placed it in another subgroup. Neither here nor in the *Cupularia* group are there spines, either to the ancestrula or to the ordinary zoëcia. In *Conescharellina* there are, if my ideas are correct, indications of radicular growth. In my former paper, p. 410, *loc. cit.*, it was shown how d'Orbigny took Lamouroux's name *Cupularia* with *urceolata* as the type, though *C. urceolata* of d'Orbigny, Canu, and others hardly seems to be the *urceolata* of Lamouroux, but a true *Lunulites*; then Busk, apparently forgetting that d'Orbigny had described a genus as *Cupularia*, made a genus a second time with *C. canariensis* as the type. There is strong reason for considering that Busk was right, as far as the species was concerned, as it resembles Lamouroux's insufficient fig. 8 and also Michelin's more than does d'Orbigny's figure. The least confusion is caused by putting under *Lunulites* the *urceolata* with radiating zoëcia, closely allied to *L. radiata*; then *Cupularia* with the zoëcia in quincunx remains for Busk's species. If this is accepted,

\* (Early Tert.), p. 105.

† (Selenariadæ), p. 407.



then *Cupuladria*, C. & B., is not required, and it is the introduction of this genus which necessitates the changes proposed.

D'Orbigny gives *Lunulites cuvieri*, Def., as *Cupularia*, but mentions Michelin's figure, which so far as can be judged is *Cupularia*, Busk, making *Cupularia*, d'Orb., untenable, thus the name was available for Busk.

*Vibracella* has a dorsal surface with the zoecia truncate and a ridge up the middle line of the zoecia, as in *Cupularia*. The ancestrula is double in both cases, but perhaps *Vibracella* should be merged in *Cupularia*, in spite of zoecial differences. *Setosella vulnerata*, B., has a vibraculum like *canariensis*, but differences prevent its being placed in the same genus, for the front is calcareous with the operculum moving against a straight calcareous edge; the zoecium has a large opesia opening, resembling that of *Rosselliana rossellii*, with the contractions varying much in extent (fig. 8). The ovicell of *vulnerata* is raised and distinct. *Setosellina*, Calv., and *Heliodoma*, Calv., are so similar to *Cupularia* that it seems doubtful whether these genera based chiefly on zoarial growth should be retained.

*Cupularia* has no ovicells, nor has *Otionella* = *Selenaria*, *Lunulites*\* and *Vibracellina* have endozoecial ovicells. Canu & Bassler, p. 238, say *Lunularia* growth occurs in *Otionella* and *Trochopora*, both placed in the Anasca Malacostega, while *Lunularia* and *Selenaria* they place in the Anasca Coilostega. *Stichoporina*, *Fedora*, and *Bipora* in the Ascophora.

The zoecia of the Coilostega have generally no zoecial spines, or but few, and the ancestrulae are mostly without spines. There is in the Cheilostomata a certain amount of relationship between the zoecial and ancestrular spines. Species having zoecia well armed with spines usually have spinous ancestrulae and, *vice versa*, species with few zoecial spines usually start from ancestrulae having few or no spines.

After the search for, and examination of, many ancestrulae, it has become easier for me, not only from the primary itself, but also from the position of the surrounding zoecia and the smaller distal zoecia, to distinguish which is the ancestrula; however, I have come to the conclusion that it would have assisted those with less experience if in my figures a special mark had been given to the ancestrula. There has not been the opportunity to describe one half of those I had listed, and there are large groups in which none are known, though

\* See *Selenariadæ*, p. 407.

my small beginnings should lead to further studies of additional characters useful in classification.

Canu and Bassler place Onychocellidae, Lunulariadae, and Microporidae as Opeculidae, and certainly the relationships of *Lunulites* seem to be here.

I am not prepared to consider that all classification should be governed by the ovicell, for though it is most useful in classification, as I have often shown, yet I dispute that it must of necessity be the most important. If we could know the embryos of most genera we should expect an enormous advance in classification, whereas the ovicell is only the containing chamber.

The question of the frequently figured, closed, or blind zoecia is very difficult, and should be attacked by someone with plenty of time and courage. Perhaps the most frequent are those with a plain calcareous front, with or without a central pore, sometimes, however, these blind zoecia have the same ornamentation as the ordinary zoecia, as in some *Cribrilinae* \*; they may be simply incrusting, taking the place of ordinary zoecia, or they may be connected to one another by tubes †; there may be long slits or a crescentic mark in about the ordinary position of the opercular aperture—this occurs in *Membraniporina regulata* ‡, C. & B., and *Conopeum similior* §, C. & B.

*Hicksina ocalensis*, C. & B. ||, and *Stamenocella midwayana*, C. & B. ¶, has a large central pore to the lower zoecia, called radicular, but can this be the function in incrusting forms with similar pores? The question as to when pores are radicular is very difficult in fossils, and no doubt they have sometimes been wrongly named, based upon insufficient evidence. *Conopeum tuberosum*, C. & B. \*\*, and *C. concavum*, C. & B. ††, also have central perforations. The pores and slits just mentioned should be compared with those of fossil *Meliceritites* ‡‡ apparently giving support to Cheilostomatous relationship, whereas the ovicells are more Cyclostomatous.

Another point should be considered, for what it may be found to be worth, is that in *Chorizopora* there are tubes from the zoecia to small chambers forming a network between the zoecia. Some of the chambers have a central round pore, such as we have been considering, whereas

\* (Cribrilinidae), pl. xvii. figs. 3, 4.

† (Ancestrula), pt. ii. pl. xxi. figs. 7, 8; pt. iv. p. 427.

‡ (Early Tert.), pl. i. figs. 1 & 2.

§ Pl. ix. fig. 8.

|| (Early Tert.), pl. xxii. fig. 13.

¶ Pl. iv. figs. 5, 9.

\*\* Pl. xix. fig. 6.

†† Pl. xix. fig. 11.

‡‡ Levinsen, 'Studies on the Cyclostomata Operculata,' 1912.

others have instead a small avicularium with a triangular mandible.

*Cupularia capriensis*, sp. n.  
(Pl. XVIII. figs. 8, 9.)

There are some very interesting specimens of *Cupularia* from Capri, which at first I took for *C. stellata*, Busk, but I am now perplexed where to place them and the name may be only provisional. They grow upon very small stones, and the one figured spreads over a part of the under surface of the stone, showing here *Cupularia* characters (fig. 9). It has smaller zoecia than *C. canariensis*, the vibracular chamber is similar, but is not always central, though in the distal region. The chief peculiarity is that in the ancestrular region there are a number of closed zoecia with a smooth calcareous frontal surface, having a large pore in the centre—the ancestrula being a similar zoecium with a slightly larger pore.

The early growth of *Membrendæcium rectum*, C. & B. \*, is quite similar, there being apparently an ancestrula of the same nature, with closed zoecia surrounding it. Canu and Bassler considered that there was a group of these closed zoecia occurring frequently round the ancestrula, but also in other places. In these characters, though not in all, the two genera are closely allied.

In *Membrendæcium duplex*, C. & B. \*, they say that in some zoecia these are mural rims thin and distinct, and these have no dietellæ; while others, in the same zoarium, have the mural rim thick and confluent, and have five dietellæ. They appreciate therefrom that too much importance † must not be attached to the dietellæ.

EXPLANATION OF PLATE XVIII.

- Fig. 1.* *Cupularia canariensis*, Busk, × 50.  
*Fig. 2.* *Cupularia denticulata*, Conrad, × 50. Is similar to *C. canariensis*, but has spinous processes from the side or front of the zoarium. This is the *C. multispinata*, Canu & Bassler. From Oran (Algiers).  
*Fig. 3.* *Cupularia umbellata*, Def., × 50. It has a calcareous plate over the front with large pores round the border, and small irregular openings on the front. From San Gemignano, Pliocene.  
*Fig. 4.* *Cupularia denticulata*, Conrad. Part from near one of the zoarial indentations, × 25, formed by the zoecia proximal to the ancestrula spreading in two directions. From Oran.

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\* (Early Tert.), p. 122, pl. xiii. figs. 1–8.

† "Early Tert.," p. 121.

- Fig. 5. Setosella rubnerata*, Busk. Showing ancestrula,  $\times 25$ . From Capri.
- Fig. 6. Ditto. Ancestrula*,  $\times 50$ .
- Fig. 7. Cupularia denticulata*, Conrad,  $\times 6$ . Specimen *fig. 4.* Zoarium of irregular shape, with the ancestrula at the left-hand corner, from which the zoecia spread out in all directions. There is a growth along the major axis and from this zoecia grow on either side, appearing at first sight as if at right angles. From Mers-el-Kebir, Oran.
- Fig. 8. Cupularia capriensis*, nov.,  $\times 25$ . From Capri.
- Fig. 9. Ditto*,  $\times 6$ . Under surface of zoarium on small stone, growing over the edge.
- Fig. 10. Cupularia canariensis*, B.,  $\times 25$ . Showing central zoecia closed and with a double ancestrula. Next comes a partial closure with irregular calcareous wall, sometimes with large pores near the border, much like *umbellata*. This is from the central part of a large colony from Princess Charlotte Bay, N.E. Australia.

LVII.—*A new Genus of Lamellibranchs* (*Hartwellia*, gen. nov.) from the Upper Kimmeridge Clay of England, with a Note on the Position of the Hartwell Clay. By F. L. KITCHIN, Sc.D., Ph.D.

[Plate XIX.]

## CONTENTS.

- I. Introduction
- II. Descriptions
- III. Affinities of the Genus.
- IV. Position of the Hartwell Clay.

## I. INTRODUCTION.

Of the many bivalve-shells found in the Jurassic rocks of England few are more familiar than J. de C. Sowerby's *Astarte hartwellensis*, so well known by the numerous well-preserved specimens displayed in many museum collections. Although this species was illustrated so long ago as 1845 by published figures of two specimens, it has still remained undescribed. Illustrations of the external aspect of the shell have appeared occasionally in text-books; but the characters of the hinge seem never to have been investigated thoroughly, and there has been no sound basis for a discussion of the probable relationships of the species. Indeed, "*Astarte*" *hartwellensis* has remained as much a mystery as,

for so long, were the beds in which it is most commonly found, forming the Hartwell Clay, exposed in excavations at Hartwell in Buckinghamshire. It is only necessary to mention the reference of this species to *Cyprina* by Deshayes, on the supposed evidence of hinges prepared by L. Saemann, who had collected specimens at Hartwell\*. In reality, there is nothing in good preparations of the interior of the shell to suggest relationship to *Cyprina*.

My attention was first directed some years ago to the most interesting characters of "*Astarte*" *hartwellensis*, those of the hinge, by two valves from which the matrix had been completely removed by Mr. S. S. Buckman. Since then, careful preparations of a number of specimens, revealing the hinges of both valves, have been made by Mr. S. W. Morgan, of the Palæontological Department of the Geological Survey. All these specimens show that, although the species occupies an isolated position by reason of the general form of the shell and the specialized characters of the hinge, its affinities are clearly Astartid. It is a derivative of one of the Jurassic stocks usually referred to the genus *Astarte*, but it represents an offshoot branch, not giving rise to descendants. Nothing resembling this species is known from strata of later age than the Hartwell Clay. The loss of the sculpture at an early stage of growth, the shallowing of the escutcheon, and the obsolescence of the lunule in later growth-stages may be regarded as characters of degeneration, the loss of long-established features in the ancestry. This form, in fact, represents one of those evolutionary side-tracks or blind alleys which seem to be illustrated by a large proportion of the species with which we have to deal in the study of palæoconchology. The difficulty, as a rule, does not lie in the recognition of the terminal offshoot species or species-groups which departed from the main line of evolution, but in identifying the representatives of those radical groups which ultimately gave rise to the nearest living forms.

The task of applying a nomenclature best fitted to express the facts of true relationship in fossil shells is always a difficult one. In the case of Jurassic and Cretaceous ammonites it is notorious how the praiseworthy efforts of specialists to indicate the independence of the innumerable separate short-lived branches thrown off from the main stocks

\* As reported by P. de Loriol and E. Pellat, "Monographie paléontologique et géologique de l'Étage Portlandien des environs de Boulogne-sur-Mer," Mém. Soc. Phys. et d'Hist. Nat. de Genève, vol. xix. part 1, 1866, p. 190, footnote.

have led to a cumbersome and frequently unlovely nomenclature\*, the outcome of intensive studies and the separate generic labelling of each recognized lateral branch-species or short genetic series, as the case may be. In the study of the fossil lamellibranchs the separation of forms requiring generic distinction in this narrow sense is more difficult; and the simpler generic nomenclature that has hitherto been employed for Jurassic species, in contrast with that of the ammonites, is due to the slower evolutionary changes, the less diversity of type displayed by the numerous side-branches, and the more imperfect character of the evidence of successive growth-stages in the bivalves. Nevertheless, the evolution of the lamellibranchs was governed by the same principles, and side-tracked forms arose suddenly among them, as among the ammonites, though usually showing less rapid specialization.

Examples of homœomorphy in separate species of bivalve-shells are more numerous and sometimes more perfect than those found among ammonites. Close resemblance in fossil lamellibranch-shells is, therefore, not always a safe criterion of near relationship. It happens not infrequently that the members of different species bearing a remarkably close resemblance to one another are so distantly related as to deserve generic separation. The study of growth-stages, coupled with the facts of zonal occurrence, sometimes demonstrates that a generic name has remained long in use to comprise such shells, distantly separated in time and not closely related, which have merely a morphological resemblance and only a remote connexion through the longer-lived parent stock. The recognition of this homœomorphy and independence is important; and when a species-group or even a single species shows striking departure from the characters of its ancestry and represents a branch soon to become extinct, the logical course, in order to express these facts, is the introduction of a distinguishing generic name. Among Mesozoic lamellibranchs the names *Gryphæa* and *Alectryonia*, for example, have each been employed to comprise many distantly related, separately derived, though

\* The names, though inevitably, are cumbersome by sheer weight of numbers; they are frequently unlovely by the choice of their authors, and in some cases have been made to appear more forbidding by the failure to latinize the component roots in accordance with conventional procedure (e. g., the generic names *Kuklokosmokeras*, *Katakosmokeras*, *Behemoth*).

morphologically similar offshoots from ostrean stocks\*. The continued practice of classifying these homœomorphs under a single generic name may be convenient, but cannot be logically defended. It retards progress, and tends to deprive geologists of data valuable in zonal stratigraphy. Apart from the guidance given by zonal position, a careful study will usually lead to the detection of constant distinctive characters, even in those forms which bear the closest resemblance to one another.

Generic subdivision on the lines indicated above is more easy to carry out when the species to be thus separated, divergent from the main stocks, are at the same time not markedly "parallel" or "convergent" with other independent lateral branches in the characters of their shell-morphology. Parallelism or convergence in the sense of these conventional terms may frequently be seen, but if it does not extend to many characters simultaneously the evolutionary relations are not thereby obscured. The examination of the post-embryonic growth-stages and the facts of the zonal occurrence can be relied upon to give a sound basis for these generic separations. The broad collective application of a single generic name, as in the case of *Astarte*, to comprise species of the present day as well as innumerable extinct shells which represent short lateral offshoot lineages, preserved as fossils from early Mesozoic time onward, conceals unnecessarily the facts of morphological diversity, evolutionary independence, and stratigraphical characterization illustrated by many of the included forms.

Yet the introduction of a more complex palæontological nomenclature has often been hailed with expressions of dismay by many geologists. It has even been sought to attach a certain opprobrium to those palæontologists who are most scrupulous and most progressive in the application of critical and analytical methods. Such geological critics have shown an imperfect realization of the important bearing of the modern palæontology on the standard of exactness in stratigraphy, by means of the zonal method. In this country, protests have been heard from eminent geologists as well as from others of less renown. For example, Prof. L. Dudley

\* F. L. Kitchin, in "Summary of Progress" for 1911, Mem. Geol. Surv. 1912, pp. 59, 60. H. Woods, "A Monograph of the Cretaceous Lamellibranchia of England," vol. ii. p. 341. Palæontographical Society, 1913. A. E. Trueman, "The Use of *Gryphæa* in the Correlation of the Lower Lias," Geol. Mag. 1922, p. 264. W. D. Lang, "Evolution: a Resultant," Proc. Geol. Assoc. vol. xxxiv. 1923, pp. 7-12.

Stamp, referring to zonal work, has recently spoken on behalf of "the ordinary geologist who cannot spend a lifetime in learning to detect the minute differences between zonal fossils on which these refinements depend." He states that while zonal work may be useful, "it is apt to appear not only superfluous, but distinctly annoying" to that kind of geologist\*. We may pass over the exaggerated reference to the need of a lifetime's work in interpreting the evidence for zonal differentiation; also the implied reflection on those who profess to be geologists, none of whom ought to feel grateful for these phrases. The quotation serves to illustrate an attitude towards detailed applied palæontology, probably adopted through misconception.

Some palæontologists have doubtless contributed a cause of this dissatisfaction by not setting forth the results of their work sufficiently fully or in clear enough language, and they might endeavour to cater more considerably for those who are less immersed than they themselves in their own special branch of study. In the introduction of new zonal names, also, inserted in the nomenclature of the stratigraphical sequence most frequently by palæontologists, it seems too often to be overlooked that a zone is a stratal unit having variable local representation and lithological development. When no description of the new zone is given and the sole definition offered is the bare name of a single species of fossil with which the geologist happens to be unfamiliar, he cannot be blamed for a certain feeling of impatience or even of antagonism. If the name introduced be described as that of a hemera, the geologist looks for some description of the corresponding stratal subdivision of the formation with which he has to deal; and too frequently he fails to find it. Yet perhaps also, those who have been ambiguously classed as "ordinary geologists," if their advocate has represented their feelings correctly, might contrive to be more appreciative in their attitude towards those progressive zonal studies which, in recent years, have contributed so strikingly in the building up of a sounder stratigraphy than that which satisfied our forefathers. Detailed palæontological work may either be left to the palæontologist, or the geologist himself may endeavour to become fully acquainted with the palæontology of the horizons that he is studying. Many geologists in this country have done this with much success and without being unduly harassed. The name of the late Prof. Charles Lapworth may be placed at the head of a long list.

\* L. Dudley Stamp, 'An Introduction to Stratigraphy,' p. 24 (London, 1923).



Despite such protests, the tide of progress in accurate zonal work continues to rise steadily, aided by the methods of more discerning generic analysis. It is evident, indeed, that with increasing knowledge and more critical study of the species, particularly when carried out with strict regard to zonal occurrence, both the zoological facts and the stratigraphical needs will warrant the introduction of a vast number of additional generic subdivisions. In the case of Sowerby's *Astarte hartwellensis*, for which the generic name *Hartwellia* is here proposed, there is no question of discriminating between this species and any homœomorph among the many forms commonly referred to *Astarte*. No species is known which closely resembles it. A separate generic name is justified by the fact that the genotype of *Astarte* is a living species, in which the characters of the hinge are different, and that this Kimmeridge form is not a member in its line of ancestry.

The generic name *Hartwellia* explains itself; and my grateful acknowledgments are due to Mr. C. Davies Sherborn, who kindly informs me that he can find no record of its previous use up to the end of the year 1924. The name is therefore likely to be still available for the genus now described.

## II. DESCRIPTIONS.

### Genus HARTWELLIA, gen. nov.

Genotype, *Astarte hartwellensis*, J. de Sowerby, 1845, 'The Mineral Conchology of Great Britain,' vol. vii, pl. cexlv. figs. 4, 5.

1864. *Atalanta*, H. G. Seeley [non J. G. Meigen, 1800], "A Help to the Identification of Fossil Bivalve Shells," The Geologist, vol. vii. p. 50.

At the present time only the characters of the genotype species of this Astartid genus are sufficiently known to provide the basis of a generic diagnosis. Numerous species in the Kimmeridge Beds usually ascribed to *Astarte* are imperfectly known and have not been systematically studied. The nearer ancestors of *Hartwellia hartwellensis*, those which lived in Kimmeridge time, may be assumed to have had laterally compressed shells with straight postero-dorsal margin, externally flattened and of somewhat elongated form, ornamented by very numerous, delicate, concrescent, linear ribs, and with deep and narrow lunule and escutcheon. Two described forms approaching such a type in their external features are discussed below; nothing, however, is yet known of their internal characters. It must therefore

be understood that a generic diagnosis based on our present knowledge may be subject to slight amendment, if closely related species come to be better known. In the meantime, the diagnosis may be drawn up to include the characters deemed likely to be most important in the generic definition.

*Diagnosis*.—Shells of Astartid character, with valves of elongated form; in neanic stage having weak posterior carination and bearing delicate concrescent linear ribs, with lunule narrow, well defined, and deeply excavated, and escutcheon narrow, deep, and limited externally by sharp ridges; later showing increasing inflation, diminishing carination, loss of ornaments, and shallowing of lunule and escutcheon. Hinge-plate shallow, elongated, strongly undercut. Left valve with a narrow triangular oblique central cardinal tooth, having an indented crest, and a smaller triangular anterior tooth; in front of this a short, steeply falling, lath-like process and an anterior-lateral elongated lip within the antero-dorsal valve-margin. Right valve with a narrow triangular oblique central cardinal tooth, having an indented crest, and a smaller anterior cardinal process, antero-ventrally inclined and carinated below: a strong anterior lateral groove of articulation and a longer posterior lateral groove, each formed by a projecting lip running parallel with the valve-margin. Pedal muscle-scar shallow, elongated, situated on the under surface of the projecting anterior lip of the hinge in each valve.

*Geological Position*.—The genus is only known from positions in the Upper Kimmeridge Clay of England, falling within the Portlandien Moyen of Continental geologists. The exact zonal levels and the localities at which it occurs are stated below, after the description of the genotype. Since the genus is at present only known to be represented by the genotype, it is uncertain when the generic characters first made their appearance, and whether suddenly or by more slow transitions.

*Remarks*.—It is possible that shells may be found at lower zonal levels in the Kimmeridge series which approach *Hartwellia hartwellensis* in the characters of the hinge and the position of the pedal muscle-attachment. In many parts of the Kimmeridge Clay the preservation of lamellibranch-shells is unfavourable for a study of internal characters. Shells either crushed flat or in a state of fragility, which are frequently the best that can be found, or the more common crushed internal casts, do not provide suitable material for thorough investigation. The cliff-sections where these beds are best exposed in continuous sequence present weathered

and crumbling surfaces unfavourable for the collection of good material. Hence the present lack of data for a comparison with the nearest related forms.

The slight posterior indentation or truncation of the pallial line has not been included in the enumeration of generic characters set forth in the above diagnosis. The value or constancy of this character in relation to the structure of the hinge is unknown in the present form, and must remain so until near forerunners can be discovered and investigated. The appearance of a shallow pallial sinus in shells of the genus *Astarte* (sensu lato) is best known in the species, both Jurassic and Cretaceous, that have usually been referred to *Eriphyla* \*; but it is uncertain how far these form a homogenetic group. It is evident that a slight pallial sinus may make its appearance from time to time in different branches of the main Astartid stocks †.

The dental formula constructed by Seeley for this genus does not represent accurately or sufficiently fully the characters of the hinge.

*Hartwellia hartwellensis* (J. de C. Sowerby). (Pl. XIX.)

1845. *Astarte hartwellensis*, J. de C. Sowerby. For reference see above, under the generic heading.  
 1864. *Atalanta hartwellensis*, H. G. Seeley. For reference see above.  
 1866. *Cyprina hartwellensis*, E. Pellat, in P. de Loriol and E. Pellat, "Monographie paléontologique et géologique de l'Étage Portlandien des environs de Boulogne-sur-Mer," Mém. Soc. Phys. d'Hist. Nat. de Genève, vol. xix. part 1, p. 190 (mention only).  
 1895. *Astarte hartwellensis*, H. B. Woodward, "The Jurassic Rocks of Britain," vol. v., Mem. Geol. Surv. p. 156, fig. 77.

*Description*.—(a) *External Characters*. The shell has an almost oval outline and flattened form in the immature stages, until a height of 20 mm. is attained, with only slight convexity. In this early period a slight though well-defined angular bend or weak carination of the valve-surface marks off a narrow posterior area, which broadens slowly with increasing age. The demarcating angular ridge extending

\* For descriptions of some of the species and for references to literature see H. Woods, "A Monograph of the Cretaceous Lamellibranchia of England," vol. ii. pp. 113–118, Palæontographical Society, 1906; F. L. Kitchin, "The Invertebrate Fauna and Palæontological Relations of the Uitenhage Series," Ann. South African Mus. vol. vii. part 2, pp. 128–135 (1908).

† Nevertheless, Dall described the pallial line as simple in the Astartidæ, in which he included *Eriphyla*. W. H. Dall, "Contributions to the Tertiary Fauna of Florida," part 3, Trans. Wagner Free Inst. Sci. Philadelph. vol. iii. part 3, p. 539 (1895).

from the umbo becomes increasingly weaker and ill-defined with advancing age.

In the adult stage the shell is subovate in outline, with the length considerably greater than the height. The valves, with relatively thin shell-wall, are moderately inflated, having the maximum convexity just above the middle and becoming more flattened below. The umbonal region is in most individuals not markedly prominent; it is moderately incurved, with the surface flattened near the apex and with obtuse umbonal slopes. The umbones are small, pointed, and forwardly directed. They are situated at a distance of one-third of the shell's total length from the anterior extremity. The height of the valve is at its maximum just posterior to the umbo.

The antero-dorsal margin falls forward usually with a gentle slope, forming a slightly concave outline. It passes gradually into the evenly convex anterior margin, which in turn merges below with shallowing curve into the long, gently convex, ventral margin. The anterior extremity corresponds approximately with the middle line of the valve in the direction of the long axis. The ventral outline rises posteriorly to pass somewhat abruptly into the short, slightly convex, posterior margin. The postero-dorsal margin is long, sloping back from the umbonal region to form a straight line in profile.

The lunule is narrow, elongated, and well excavated posteriorly, where it is bounded externally by rounded overhanging ridges of the valves; anteriorly it loses definition and merges into the antero-dorsal surface of the valves. The escutcheon is of long, narrow, lanceolate form and is bounded externally by acute ridges. Its maximum depth measures about one-third to one-half of its greatest breadth. Its surface on each side falls steeply from the bounding ridges in the anterior half, where, in each valve, it is concave in form, but it is less steep and more flattened posteriorly. It is marked throughout by numerous well-defined growth-ridges. The ligament extends back to nearly one-third of the length of the escutcheon.

The surface is ornamented in the youthful stage, until a height of about 6 mm. has been attained; at these dimensions closely spaced, delicate, rounded linear ribs, about 20 to 25 in number, run parallel with the lines of growth. They bend up somewhat abruptly where they enter the posterior area, which they cross with a straight course and slightly forward inclination, terminating at the sharp margin of the escutcheon. The last-formed two or three ribs are

sometimes imperfectly developed. During subsequent growth-stages the valve-surface is marked only by fine lines and ridges of accretion.

(b) *Internal Characters.* The hinge-plate in each valve is relatively shallow, with rounded lower margin, and is strongly undercut. In the *left valve* the margin of the valve posterior to the hinge-plate, and bordering the escutcheon, serves for the posterior lateral articulation with the elongated posterior groove of the opposing valve. The inner side of a part of this margin is marked by numerous short parallel striæ directed at right angles to the border. At the postero-dorsal margin of the hinge-plate there is a narrow raised oblique thickening or fold of the plate adjacent to the inner border of the escutcheon. Immediately in front of this is the central cardinal tooth, which is directed back from the umbo very obliquely. It is of narrow elongated form and is marked by a narrow central longitudinal depression of its surface. Immediately behind its lower end and bordered by the lower margin of the hinge-plate is a small shallow subtriangular or poorly-defined recess. The central cardinal tooth is bounded in front by a narrow deep triangular recess, directed obliquely backwards and downwards from the umbo, pointed above and broadening below, for the reception of the main cardinal tooth of the right valve. This recess is bounded anteriorly by a small prominent triangular tooth, below and in front of which is a small deep triangular recess limited in front by a short, prominent, steeply falling, lath-like process. Confluent with the lower end of this process and forming an obtuse angle with it is an elongated swelling or lip, just within the antero-dorsal margin of the valve and running parallel with it, for articulation with the anterior groove of the right valve. The surface of this lip is marked by numerous delicate transverse striæ directed at right angles to the valve-margin.

In the *right valve* a long ledge or lip with smooth rounded margin, situated immediately below the postero-dorsal margin of the valve and running almost parallel with it, forms with the valve-border an elongated posterior groove of articulation. The lip projects interiorly beyond the valve-margin and its upper surface is marked by numerous short delicate transverse striæ. Behind the umbo and adjacent to the inner margin of the escutcheon is an elongated swelling of the upper margin of the hinge-plate. The triangular central cardinal tooth is directed obliquely backwards from the umbo. It is narrow in form, is sharply pointed above, and broadens slowly below. A longitudinal

depression of its surface gives rise to the appearance of marginal ridges. Behind the tooth is a narrow triangular oblique recess; in front of it a broader recess, the floor of which slopes up forwardly to the crest of a process or incipient tooth directed forwardly and downwardly, narrowing and carinated below. This process joins a ledge or broad lip, projecting beyond the interior surface of the valve below the margin of the lunule and extending forward to the margin of the anterior adductor impression. Its upper surface is marked by fine transverse striæ. A narrow elongated swelling with rounded surface, running parallel with the lunular margin of the valve and separated from it by a fine linear groove, forms with the ledge below the deep anterior groove of articulation.

The anterior adductor muscle-scar is of broadly oval form and is not deeply impressed. The small pedal muscle-scar is of shallow and elongated form, and is situated on the under surface of the anterior ledge of the hinge in the right valve and of the corresponding lip in the left valve. The pallial line has a short shallow sinus. The posterior adductor muscle-scar is subcircular in form, is weakly defined, and is situated close to the postero-dorsal margin of the valve. The inner side of the pallial margin of the valve is smooth.

*Dimensions :—*

	(1)	(2)	(3)	(4)	(5)
	mm.	mm.	mm.	mm.	mm.
Maximum length .....	18	29	70	75	87
Maximum height .....	12	18	40	50	58
Depth of a single valve ..	3	5	18	15	19

Specimens (1) and (2) are from the *rotundum*-zone, Swindon; (3), (4), and (5) are from the Hartwell Clay (*pallasioides*-zone) of Hartwell, Buckinghamshire. All are in the collection of the Geological Survey.

*Horizon and Localities.*—This species makes its first appearance, so far as we know, in the *rotundum*-zone, where it occurs not uncommonly, as at Swindon. It is also known to be present in that zone at Culham, Oxfordshire, as shown by a fine example exhibited in the University Museum, Oxford. The overlying *pallasioides*-zone of Dr. Neaverson's classification, best exposed at Hartwell, Buckinghamshire, and generally known as the Hartwell Clay, has yielded the majority of the fine specimens seen in museum collections. The species is found at a corresponding horizon at Brill, Oxfordshire. The *pallasioides*-zone appears also to have representation in the top part of the Swindon Clay, which

contains ammonites and lamellibranchs of the Hartwell fauna, including *Hartwellia hartwellensis*. Dr. Neaverson's zones of *Pallasiceras rotundum* and *Holcosphinctes pallasioides* constitute the "*pallasianum*"-zone as adopted from Prof. Salfeld's classification by the Geological Survey. In the characters of their fauna the two component zones appear to be intimately related, and *Hartwellia hartwellensis* may be regarded as one of the most useful distinguishing forms for the purpose of correlation.

Poorly preserved specimens of this species were found in the core from the deep boring at Penshurst, Kent\*, in the clays above the *Saccocoma* horizon, thus in beds corresponding in position with the "*pallasianum*"-zone elsewhere.

The fact that *Hartwellia hartwellensis* is little known outside parts of Buckinghamshire, Oxfordshire, and Wiltshire is likely to be due less to restricted lateral distribution than to other circumstances. On the coasts of Dorset and the Boulonnais the relatively fragile shells of this species are perhaps seldom procurable on the weathered cliff-surfaces. It is not improbable that the shell preserved as an internal cast, from a horizon in the Boulonnais equivalent to the lowest part of the Hartwell Clay, described by de Loriol as *Ptychomya? portlandica*†, is a specimen of *Hartwellia hartwellensis*. The cast appears to be that of a shell with a deeply undercut hinge-plate, while the position of the posterior adductor impression close to the margin of the valve is the same as in *Hartwellia*.

*Remarks.*—The larger of the two specimens figured by J. de C. Sowerby in 1845, shown by him (fig. 5) in lateral and dorsal aspects, is preserved in the British Museum (Natural History), registered 44037. It is a well-preserved individual showing the fossilized ligament. The lateral view is not depicted quite accurately, appearing in the figure a little too high in outline in relation to the length, and not sufficiently produced anteriorly. The sculpture of the early stages is much coarser in the figures than in the specimen.

The shells of this species, despite some variation, show general constancy in the external characters. With advancing growth a considerable increase takes place in the convexity

\* F. L. Kitchin, in G. W. Lamplugh and F. L. Kitchin, "On the Mesozoic Rocks in some of the Coal Explorations in Kent," Mem. Geol. Surv. 1911, pp. 194, 195.

† P. de Loriol and E. Pellat, "Monographie paléont. et géol. des étages supér. de la Formation Jurassique des Environs de Boulogne-sur-Mer," Mém. Soc. Phys. et d'Hist. Nat. de Genève, vol. xxiv, 1<sup>re</sup> Partie, 1875, p. 262, pl. xv. fig. 45.

of the valves, and with the approach to full dimensions there is usually a greater increase in the relative height-measurement. Variation is chiefly shown in the degree in which this increased height is attained, in the inflation of the valves, the depth of the escutcheon, and the development and continuance of the weak posterior carination. This last character is never very pronounced, but the faint angularity of the surface dies away with increasing age more rapidly and completely in some specimens than in others. There is a notable uniformity in the external characters of the ornamented adolescent stage.

The large dimensions attained are one of the striking characteristics of this form, and it is noteworthy that the shell remains thin-walled and does not show the prodigal thickening so often seen in the terminal representatives of lamellibranch-species. Many of the large specimens in the Hartwell Clay have the valves united, and the fossilized ligament is not infrequently preserved.

So far, the species has been found exclusively in finely sandy clays, thus showing a choice of habitat similar to that preferred by species of *Astarte* of the present day, which usually live on a sandy mud bottom at some distance from shore. Certain specimens from the sandy beds of the *pectinatus*-zone, of shallower water origin, have in the past been ascribed to *Astarte hartwellensis*, but on examination they have proved to belong to a distinct species and to be unrelated. The near forerunners of *Hartwellia* may, however, possibly be found to occur in a corresponding position below the "*pallasianum*"-zone in beds of argillaceous facies.

The character of crenulation of the inner side of the pallial margin, seen in many species of "*Astarte*," is apparently not of more than specific value. There is no sign of this feature in the present species. E. A. Smith considered that the presence or absence of crenulation is of importance in the discrimination of species, but stated that, with some other observers, he believed the character, when present, to be a mark of maturity\*. Among the species usually ascribed to *Eriphyla*, some always have smooth margins, as seen in *E. lenticularis* (Goldfuss) and *E. striata* (J. de C. Sowerby), while others always have crenulate margins, for example, *E. laevis* (Phill.) and *E. herzogi* (Goldf.). Some inconstancy in regard to this character, however, is known in well-grown valves of a single species.

\* Edgar A. Smith, "Observations on the Genus *Astarte*, with a List of the known Recent Species," Journ. Conch. vol. iii. 1881, pp. 197, 198.



Forerunners in the ancestral line of *H. hartwellensis* may well have had crenulation within the margin.

A minor structure shown in the shells of this species, calling for remark, is the delicate transverse striation on the articulating surfaces of the elongated antero-lateral and postero-lateral lip-like processes. This is doubtless of secondary character and has apparently become evolved in these elongated shells, possessing a relatively weak cardinal apparatus, as an aid in giving a grip between the valves and in reducing any proneness to a differential slipping movement along the plane of symmetry in the direction of the long axis\*. Such a character can scarcely be regarded as of more than specific value.

### III. AFFINITIES OF THE GENUS.

The genus *Astarte* was founded by J. Sowerby in 1816, and a recent species, *A. scotica* (Maton & Rackett) was chosen as the genotype†. *Astarte scotica* has been regarded by various authorities as a synonym of *A. sulcata* (Da Costa)‡. The name *Astarte* was applied by Sowerby to Jurassic as well as to recent species, and it has since been commonly used for many Mesozoic and Tertiary forms which have a general relationship. The name has been thus applied loosely to include a large number of species which, while differing in important features from the genotype, gave rise to no lineage through which the recent species became ultimately derived. Only a few of these forms have hitherto been separated under distinctive generic names§. The characters\* of the genus *Astarte* appear, nevertheless, to have become established at an early time and to have been maintained in species occurring at many horizons in the Jurassic system. For example, shells agreeing in the characters of the hinge and other features of the genus so well that they cannot be separated are found both in Lower and Upper Kimmeridge beds, as in the *Rasenia*-zones and

\* Compare Dall's remarks on the secondary striations seen in the teeth of various genera, W. H. Dall, *op. cit.* p. 495.

† J. Sowerby, 'The Mineral Conchology of Great Britain,' vol. ii. p. 85, 1816.

‡ For the synonymy of *A. sulcata* see E. A. Smith, *op. cit.* p. 206. The characters of the species were described by E. Forbes and S. Hanley, 'A History of British Mollusca and their Shells,' vol. i. 1853, p. 452, pl. M, fig. 5; vol. iv. 1853, pl. xxx. fig. 6. Also J. G. Jeffreys, 'British Conchology,' vol. ii. 1863, p. 311; vol. v. 1869, pl. xxxvii. fig. 1.

§ F. Stoliczka recognized the necessity of separating certain forms from the genus *Astarte* ('The Cretaceous Fauna of Southern India,' vol. iii., The Pelecypoda, p. 278, 'Palæontologica Indica,' 1871).

in the *pectinatus*-beds and Hartwell Clay. It is not among these, however, that we must look for the nearer relatives of *Hartwellia*, but in forms which became specialized and divergent at an earlier time.

For the group of well-characterized species illustrated by J. Sowerby's *Astarte excavata*\* (Inferior Oolite), the late Prof. G. Boehm proposed the name *Cælastarte*, which he regarded as a sectional designation†. The group as at present known may be raised to the rank of a genus, and further subdivision should be possible when the species come to be studied with reference to their post-embryonic ontogeny and zonal relations. This generic group, as viewed broadly, has representation throughout the Jurassic rocks and appears to have persisted into Lower Cretaceous time‡; but it is evident that lateral offshoots branched off from time to time and became extinct. *Hartwellia* may best be brought into connexion with *Cælastarte* (sensu lato), and it may be regarded as one of the more specialized side-branches which did not give rise to descendants.

In *Cælastarte excavata* itself the thickened and massive shell is ornamented in all stages of growth, though with decreasing regularity in the later part of the development; the form of the valves is more inequilateral, shorter and more elevated in outline than in *Hartwellia*, while the hinge is of a much more massive type. The internal characters are well illustrated by figures given by Boehm of French specimens from the Bajocien of May (Calvados)§, which show close agreement with typical English individuals from the Inferior Oolite of Rodborough and Dundry. The deep hinge-plate, forming a raised platform, is not undercut, the anterior cardinal tooth of the left valve is narrow and prominent, and there is a narrow weak posterior groove of

\* J. Sowerby, 'The Mineral Conchology of Great Britain,' vol. iii. p. 57, pl. ccxxxiii. 1819.

† G. Boehm, "*Cælastarte* und *Heteropsis*," Ber. der Naturforsch. Gesellsch. zu Freiburg i. B., Band vii. p. 169, 1893.

‡ Species having the compressed form, concentric ribbing, and deep lunule and escutcheon with acute bounding ridges occur in the Lias—for example, *Astarte acutimargo*, F. Roemer, 'De Astartarum Genere et Speciebus, quæ e saxis Jurassicis atque Cretaceis proveniunt,' p. 14, fig. 1, Berlin, 1842. *Astarte rzezhaki*, G. Boehm, may be cited as a late Jurassic example having much external resemblance to species of lower horizons. G. Boehm, "Bivalven der Stramberger Schichten," Palæontographica, Suppl. Band ii. Abth. 4, 1883, p. 558, pl. lxii. fig. 33. The Lower Cretaceous *Astarte longlandsiana*, Tate, should also probably be included (R. Tate, "On some Secondary Fossils from South Africa," Quart. Journ. Geol. Soc. vol. xxiii. 1867, p. 158, pl. viii. figs. 5 a, 5 b).

§ G. Boehm, *op. cit.* pl. viii. figs. 1, 2.

articulation in each valve, incised, as it were, along the upper margin of the hinge-plate. The pedal muscle attachment is situated on the lower margin of the hinge-plate beneath the lunule. While affinity to *Cœlastarte* is strongly suggested in the early growth-stages of *Hartwellia* by the flattened form of the valves, the concentric ornaments, the deep and narrow lunule and escutcheon, and the sharp postero-dorsal ridges bordering the escutcheon, the hinges of the two genera are well contrasted in their details, although the cardinal teeth seen in the genotype of *Cœlastarte* present a ground-plan compatible with the relationship indicated. Even the central depression along the crest of the main cardinal teeth, so well developed in *Hartwellia*, is already shown, though less clearly, in the Inferior Oolite species. *C. excavata*, however, was itself probably not a direct forerunner of *Hartwellia*, but a terminal or nearly terminal representative of its own branch-lineage.

The evolution of the hinge of *Hartwellia* should be considered in connexion with the elongated figure and light build of the valves. The reduction of depth of the hinge-plate and the relatively light and slender character of the cardinal teeth are appropriate to the proportions and weight of the shell. The acquirement of perfected anterior-lateral and posterior-lateral means of articulation, by the formation of strongly developed grooves, may be regarded as a compensation for the weakened cardinal region, effectively providing against any tendency to differential rotatory movements of the elongated valves when these were closed for the protection of the animal.

A species of the Inferior Oolite distinct from *Cœlastarte excavata* shows this connexion between elongation of the shell and elaboration of the lateral elements of the hinge. This is *Cœlastarte praelonga* (Rollier) \*, from the Aalenian of Lorraine and the eastern part of the Jura district, allied to *C. excavata*, but having a more elongated form. Rollier considers this species to be identical with the shells of elongated figure described by E. W. Benecke † as a variety of Sowerby's *Astarte excavata*. The excellent preparations of the hinges of both valves figured by Rollier ‡ show, in

\* L. Rollier, "Fossiles Nouveaux ou peu connus des Terrains Secondaires du Jura et des contrées environnantes," Mém. Soc. Pal. Suisse, vol. xxxviii. 1912, p. 103, pl. viii. figs. 4, 4 a-c.

† E. W. Benecke, "Die Versteinerungen der Eisenerzformation von Deutsch-Lothringen und Luxemburg," Abhandl. Geol. Spezialkarte Elsass-Lothringen, N.F., Heft vi. 1905, p. 225, pl. xvi. figs. 17, 18.

‡ Attention may be directed to Rollier's method of freeing these shells from matrix (op. cit. p. 106).

accordance with the greater elongation of the shell, a shallowing and drawing out of the hinge-plate, which exhibits also the character of incipient undercutting. The formation of anterior and posterior lateral grooves of articulation in the right valve is well shown, but these are of a somewhat different type from those of *Hartwellia*. Although it cannot be supposed that *Cœlastarte prælonga* stands in the direct line of ancestry of *Hartwellia*, that species is interesting in illustrating how the strengthening of the lateral grooves goes hand-in-hand with the increased length of the shell, as a mechanical advantage which is shown still more strikingly in *Hartwellia*.

It is among the later members, however, of the broad generic group of *Cœlastarte* that search should be made for the nearer relatives of *Hartwellia*. The characters of the early growth-stages in this genus suggest that these near ancestors were probably laterally compressed shells with fine concrescent ornaments, with weak posterior carination of the surface, and with straight postero-dorsal margin. In Lower Kimmeridge beds such a form is seen in "*Astarte*" *bernojurensis*, Etallon\*, from the Virgulien in the Bernese Jura. The characters of the hinge are not known; but in the compressed and elongated form of the valves, as in the other essential external features, there is conformity with the type of shell expected in theory to be in the near ancestral line of *Hartwellia*. Another species similar to "*Astarte*" *bernojurensis*, but with less elongation of the valves and a higher outline, is "*Astarte*" *monsbeliardensis*, Contejean†, likewise from the Virgulien. It is probable that when the bivalve-fauna of the higher zones in the Kimmeridge series becomes better known there will be found species which will enable us to trace with greater certainty the nearer forerunners of the aberrant *Hartwellia*.

#### IV. POSITION OF THE HARTWELL CLAY.

The Hartwell Clay of Buckinghamshire has long been known for its rich molluscan fauna, so preserved that the shells of the ammonites and lamellibranchs retain their original form. Perhaps owing to the fact that the subjacent strata are not exposed in that particular district, the

\* J. Thurmann and A. Etallon, "Lethea Bruntrutana," *Neue Denkschr. Allgem. Schweiz. Gesellsch.* vol. xix. 1862, p. 192, pl. xxiii. fig. 12.

† C. Contejean, 'Étude de l'Étage Kimméridien de Montbéliard et dans le Jura,' p. 262, pl. xi. fig. 1, Paris, 1859. J. Thurmann and A. Etallon, *op. cit.* p. 192, pl. xxiii. fig. 13 [as *Astarte suprajurensis*].

exact position of the clay in the Kimmeridge-Portland series remained for long in doubt in the minds of many English geologists. L. Sæmann, however, who visited Hartwell more than half a century ago, referred the Hartwell Clay to the Kimmeridge Clay and correlated it with the Middle Portlandien of the Boulonnais \*, with the upper part of which it actually corresponds. He recognized that the Lower and Middle subdivisions of the Portlandien stage of the French classification are equivalent to a part of the Kimmeridge Clay of the type-area in England, a fact not always understood by those English geologists who have allowed themselves to be confused by the dual nomenclature. The relations are made clear in Mr. Pringle's table showing the correspondence between these rocks as developed in the Boulonnais and in England †.

It must be admitted that the study of the Kimmeridge Clay was for many years unduly neglected in this country, and the careful palæontological work by which alone this series could be zonally subdivided, so that its local exposures might be accurately correlated, was not undertaken. The late Prof. J. F. Blake made a special study of the formation, but the result was not a sound contribution to our knowledge. W. H. Hudleston referred to the Kimmeridge Clay as "difficult to tabulate or understand"; while the pronouncement in an official geological publication that there is no need in this country to divide the series into more than two zones for general stratigraphical purposes ‡ was a mere confession of failure. The names of ammonites unfortunately chosen as the two zonal indices were those of species which do not occur in the Kimmeridge Clay. The formation where most fully developed, as in Dorset and Kent, attains a thickness of more than 1000 ft., and it shows such changes of fauna from its base to its summit that it is readily divisible into a number of well-characterized zones. It was left to a foreign geologist, Dr. H. Salfeld, to lay the first foundation of a zonal classification in 1913.

Blake, in 1875, ascribed the clay at Hartwell to the Lower Kimmeridge§; but in a later paper he admitted that he had

\* As set forth by P. de Loriol and E. Pellat, "Monographie paléont. et géol. de l'Étage Portlandien des environs de Boulogne-sur-Mer," Mém. Soc. Phys. et d'Hist. Nat. Genève, vol. xix. part 1, 1866, p. 190, pl. i. fig. 7.

† P. Pruvost and J. Pringle, "A Synopsis of the Geology of the Boulonnais," etc., Proc. Geol. Assoc. vol. xxxv. 1924, p. 46.

‡ H. B. Woodward, 'The Jurassic Rocks of Britain,' vol. v.; "The Middle and Upper Oolitic Rocks of England (Yorkshire excepted)," Mem. Geol. Surv. 1895, p. 152.

§ J. F. Blake, "On the Kimmeridge Clay in England," Quart. Journ. Geol. Soc. vol. xxxi. 1875, p. 211.

been in error, and he then referred it to the Upper Kimmeridge\*. The late Mr. H. B. Woodward concluded that on stratigraphical and palæontological grounds the Hartwell Clay belongs to the Lower Portland Beds. Yet he cited *Astarte hartwellensis* as a common and characteristic fossil of the Kimmeridge Clay†. Jukes-Browne in his 'Student's Handbook' adopted the same view. He tabulated the Hartwell Clay as Lower Portland, citing *Astarte hartwellensis* among its fossils, while on another page the same species is illustrated as a Kimmeridge form‡. It should be remarked that the brief account of the Kimmeridge Clay given in that well-known text-book is found to be inadequate and misleading, when viewed in the light of present knowledge. We may note that, in the employment of the term "Lower Portland Beds," Woodward and Jukes-Browne were not adopting the French usage, but that of the Geological Survey, which followed Fitton in placing the base of the Lower Portland Beds (Portland Sands) in Dorset at about 120 ft. below the base of the Portland Stone series. The Hartwell Clay was thus ascribed to a zonal position not only too high in the geological scale, but also unrepresented by strata in Buckinghamshire, where there is a considerable gap between the highest local Kimmeridge Clay (called the Hartwell Clay) and the lowest zone of the local Portland series which rests unconformably upon it. That basal Portland zone of the development near Aylesbury is not equivalent to the lowest part of the Portland Sands (Lower Portland) of the Dorset coast, but to their highest part; and, as we shall see, the Hartwell Clay does not even correspond with the highest part of the Kimmeridge Clay of the type-section in Dorset, as defined by the Geological Survey, but with beds situated some distance below.

Prof. Salfeld's zonal work has been of great service§; but he was misled into ascribing his "*Perisphinctes*" *eastlecotensis* and "*P.*" *pectinatus* (Phill.) to a position at Swindon above the Swindon Clay instead of below it. This resulted in a curious confusion in the order of some of the zones as set out by him, so that the Hartwell Clay was correctly referred to a position above the Oil-shales of Kimmeridge,

\* J. F. Blake, "On the Portland Rocks of England," Quart. Journ. Geol. Soc. vol. xxxvi. 1880, p. 213.

† H. B. Woodward, *op. cit.* pp. 156, 157, 169, 223.

‡ A. J. Jukes-Browne, 'The Student's Handbook of Stratigraphical Geology,' 2nd ed. 1912, pp. 436, 444, 445, 447.

§ H. Salfeld, "Certain Upper Jurassic Strata of England," Quart. Journ. Geol. Soc. vol. lxxix. 1913, p. 423; "Die Gliederung des oberen Jura in Nordwesteuropa," etc., Neues Jahrb. für Min., Beilage-Band xxxvii. 1913, p. 125 (zones given in Tab. i.).

at the same time was placed incorrectly below the *pectinatus* and *eastlecottensis* horizon of Swindon, of approximately the same age as the Oil-shales. Subsequent work has put the matter in its proper light. Messrs. Chatwin and Pringle\* have shown that the so-called "Lower Portland Sands" of Swindon, yielding *Wheatleyites eastlecottensis* and *Pectinatites pectinatus*, and occupying a position below the Swindon Clay, correspond with the Oil-shale horizon at Kimmeridge Bay, thus confirming a correlation suggested by Hudleston many years ago. These beds therefore represent a shallow-water development of a part of the Upper Kimmeridge Clay. Like the Shotover Grit Sands of Shotover and the Wheatley Sands of Wheatley, also formerly classed as Lower Portland Sands, they belong to the *Pseudovirgatites*-zone of the classification adopted in 1923 by the Geological Survey†, the *pectinatus*-zone of Dr. E. Neaverson's later classification‡.

The clays overlying the *pectinatus*-zone are characterized by broad-whorled ammonites with coarse "biplex" ribbing, *Pallasiceras rotundum* (J. Sow.) and allied species. The clays just above their horizon, forming the Hartwell Clay as excavated near Aylesbury, contain *Holcosphinctes pallasoides*, Neaverson§, selected by Dr. Neaverson as the principal zone fossil. The *rotundum*-zone and the overlying *pallasoides*-zone of Dr. Neaverson form the "*pallasianum*"-zone of Prof. Salfeld and the Geological Survey. Ammonites of the *rotundum*-fauna have been obtained, according to Dr. Neaverson, from below the *pallasoides*-clay at Hartwell and Aylesbury. They occur also at Wheatley in the clay overlying the *pectinatus*-sands and in the Swindon Clay. Specimens of ammonites obtained from an excavation recently made in the top part of the Swindon Clay appear indistinguishable from Dr. Neaverson's *Holcosphinctes pallasoides*, showing that the Hartwell Clay is partly represented

\* C. P. Chatwin and J. Pringle, "The Zones of the Kimmeridge and Portland Rocks at Swindon," in "Summary of Progress" for 1921, Mem. Geol. Surv. 1922, Appendix vi. p. 162.

† J. Pringle and F. L. Kitchin, in G. W. Lamplugh, F. L. Kitchin, and J. Pringle, "The Concealed Mesozoic Rocks in Kent," Mem. Geol. Surv. 1923, p. 227 & pl. ii. See also J. Pringle, "The Geology of the Country around Oxford," 2nd ed., Mem. Geol. Surv. 1926, pp. 66, 67.

‡ E. Neaverson, "The Zonal Nomenclature of the Upper Kimmeridge Clay," Geol. Mag. 1924, p. 146; "Ammonites from the Upper Kimmeridge Clay," University Press of Liverpool, 1925, pp. 8, 37.

§ It is desirable to have more information than that given by Dr. Neaverson concerning the differences between *Holcosphinctes* and *Pallasiceras*.

there. On the Dorset coast ammonites of the *rotundum*-fauna were found, first by Mr. Pringle, at Chapman's Pool, more than 100 ft. below the top of the Kimmeridge Clay, and in the clays which there overlie their horizon. Dr. Neaverson has seen specimens resembling his *Holcosphinctes pallasoides*.

The Hartwell Clay therefore occupies a high position in the Kimmeridge Clay. At Wheatley, Shotover, and Swindon the corresponding clay has been largely denuded away, and only a variable remnant of it is present, overlain unconformably by Portland beds not belonging to the lowest part of that series. In the expanded clays of the Upper Kimmeridge met with in deep borings in Kent, the evidence obtained, as at Penshurst, points to the presence of ammonites of the *rotundum* and *pallasoides* zones well above the *Saccocoma*-horizon (which is at the base of the Oil-shale horizon of Dorset) but not below it. The presence of *Hartwellia hartwellensis* in the same part of the series gives further evidence in support of this correlation\*.

The relations may be set out in summarized form as follows:—

Dorset.	Swindon.	Buckinghamshire.
Portland Stone.	Portland Stone.	Portland Stone.
Portland Sands.	Portland Sands missing, except top-most part ( <i>gorei</i> -zone).	Portland Sands missing, except top-most part.
Base of Portland Sands.		
Kimmeridge Clay not yet zonally classified; about 100 ft.	Missing.	Missing.
Equivalents of Hartwell Clay, with <i>rotundum</i> -zone at base.	Swindon Clay, part of <i>pallasoides</i> -zone at top, <i>rotundum</i> -zone below.	Hartwell Clay, <i>pallasoides</i> -zone, with <i>rotundum</i> -zone at base.
Oil-shale horizon, <i>Saccocoma</i> at base.	Sands with <i>Wheatleyites</i> and <i>Pectinatites</i> .	Unexplored and not exposed.

Underlain by clays of the *Virgatites*-zone (Geol. Survey), including Dr. Neaverson's *nodiferus*-zone (above) and *wheatleyensis*-zone (below).

\* F. L. Kitchin, "The Palæontological Characters and Correlation of the Strata between the Gault Clay and the Trias," in G. W. Lamplugh and F. L. Kitchin, "On the Mesozoic Rocks in some of the Coal Explorations in Kent," part ii. Mem. Geol. Surv. 1911, pp. 193-195.



This, in outline, is the interpretation that seems to be in closest agreement with the observed facts, and it effectively clarifies the long-existing confusion.

At Shotover and Wheatley the relations are very similar to those at Swindon\*. The clays below the sands with *Wheatleyites* and *Pectinatites* contain species of *Virgatosphinctoides*, but no trace of the *rotundum* and *pallasioides* faunas. The clay overlying the sands yields *Pallasiceras*. The bed of Portland age which there rests on this denuded remnant of the *rotundum*-zone contains numerous lydite-pebbles, as at Swindon. At Swindon this basement-bed of the local Portland yields many phosphatized fragments of *Pallasiceras*, doubtless derived from the underlying Swindon Clay. Dr. Neaverson stated in his correlation-table that this phosphate-bed represents the *pallasioides*-zone and the overlying Portland Sands of the full sequence; but the reasons for that conclusion were not given, and, in fact, that reading is not in accordance with Dr. Neaverson's own diagram of sections†. Both the table and the diagram fail to show that the phosphate-bed is the base of the *gorei*-zone (top of the Portland Sands) and that below it there is an actual gap in the series, represented by some 240 ft. of strata in Dorset.

The correlation of the Hartwell Clay above set out is the one adopted by Mr. Pringle, Mr. Chatwin, and myself, and in its main points by Dr. Neaverson. Among those who have recently devoted attention to the Kimmeridge Clay of this country, Mr. S. S. Buckman seems to be alone in dissenting from it. He maintains that the Hartwell Clay occupies a position below the *Wheatleyites* and *Pectinatites* beds‡, but I consider the evidence upon which he bases this view to be unsatisfactory. It is difficult to understand, assuming his interpretation to be sound, how we can account for the absence of the *pallasioides*-fauna below those sandy beds at Wheatley, Shotover, and Swindon, and below the *Saccocoma*-horizon in Dorset and in Kent.

The question of the zonal nomenclature of the Kimmeridge Clay is one that might be discussed at great length, but it is beyond the scope of this paper. Different zonal schemes for the formation as developed in this country have been put

\* J. Pringle, "The Geology of the Country around Oxford," 2nd edit. Mem. Geol. Surv. 1926, pp. 70-73.

† E. Neaverson, "The Zonal Nomenclature of the Upper Kimmeridge Clay," Geol. Mag. 1924, pp. 150, 151.

‡ S. S. Buckmann, 'Type Ammonites,' vol. iv. pp. 26-28, Dec. 1922; pp. 29, 33-36, Feb. 1923; vol. vi. pp. 27, 28, Aug. 1926.

forward by Prof. Salfeld, Dr. A. Morley Davies, the Geological Survey, Dr. Neaverson, and Mr. Buckman. Pellat and Rigaux had a different set of names again for the corresponding zonal development in the Boulonnais, while Dr. Spath has proposed a zonal nomenclature of the Kimmeridge series of more general applicability. In any attempt at unification, broader questions concerning the principles of stratigraphical nomenclature would be involved. As regards the names applied both to the major and minor subdivisions of formations, the present usages are full of inconsistency, and each investigator seems at liberty to adopt his own method. This freedom and want of coordination make correlation-work an increasingly formidable task.

## EXPLANATION OF PLATE XIX.

*Hartwellia hartwellensis* (J. de C. Sowerby).

The specimens are all in the collection of the Geological Survey; their register-numbers are quoted in brackets. The original of fig. 2 is from the Swindon Clay of Swindon, Wiltshire. The remaining specimens are from the Hartwell Clay of Hartwell, Buckinghamshire.

**Fig. 1.** Hinge of left valve, natural size. The surface of the posterior cardinal tooth is somewhat corroded. [27190.]

**Fig. 2.** The external ornament of the adolescent stage,  $\times 3$ . [37977.]

**Fig. 3.** Hinge of right valve, natural size. [27192.]

**Fig. 4.** Specimen showing both valves. Dorsal view, natural size. [37976.]

**Fig. 5.** Right valve of the same specimen. Lateral view, natural size. The anterior margin has been slightly restored. [37976.]

**LVIII.**—*On a Trichostrongylid Nematode from the Wood-mouse* (*Apodemus sylvaticus*). By H. A. BAYLIS, M.A., D.Sc.

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**DURING** some recent investigations of the parasites of field-mice near Oxford Mr. C. S. Elton has sent to the writer at different times a large number of specimens for identification. Most of these were from the long-tailed field-mouse, or wood-mouse (*Apodemus sylvaticus*). The most interesting species from this host, and one which seems to occur in the intestines of a large proportion of the individuals examined, is the small *Trichostrongylid* Nematode which forms the subject of this paper. It possesses characters which are difficult to reconcile with those of any known genus. It belongs to the subfamily

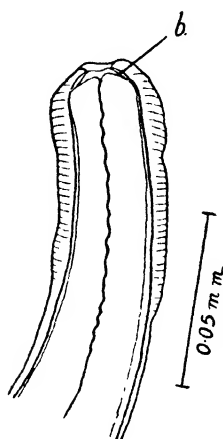
*Heligmosominæ*, as is shown by the posterior position of the vulva and the unpaired condition of the genital tube in the female. Of the genera included in this group, as they are at present defined, it approaches, perhaps, most nearly to *Nematospira*, Walton, 1923, and to *Heligmosomoides*, Hall, 1916. In its most striking feature (the marked asymmetry of the lateral lobes of the bursa in the male) it resembles *Nippostrongylus*, Lane, 1923. From all these genera, however, it differs in rather important particulars, and, judged by the standard of the characters upon which other genera in this subfamily have been erected, it appears to represent a new genus. Whether the species is also a new one is a question of some difficulty, as will appear in the discussion. Provisionally, however, it is here treated as such.

*Nematospiroides dubius*, gen. et sp. n.

The adult worms occur chiefly in the lumen of the upper part of the intestine, but immature forms occur coiled up in submucous cysts in its wall. A few rhabditiform larvæ, which may possibly have belonged to this species, were found by Mr. Elton among the fur of one of the mice examined. The adults are reddish during life, and, even after fixation with hot alcohol, form a close elongate spiral of numerous turns, it being impossible to straighten them without causing injury. This coiled condition renders accurate measurements of length impossible. Typical male specimens measure, roughly, 6 mm. or a little more in length, and females about 13 mm. The maximum thickness of the body is about 0.11 mm. in the male and 0.12 mm. in the female, the thickest portion of the female being towards the posterior end, a little in front of the vulva. The cuticle near the head-end is slightly expanded, the diameter in this region being 0.033–0.036 mm. in the male and 0.04–0.043 mm. in the female. The diameter of the head, exclusive of the cuticle, is 0.023–0.03 mm. The cuticle of the body bears very fine transverse striations, which are inconspicuous except near the anterior end and in the neighbourhood of the vulva in the female. In addition the body is ornamented externally throughout its length with about thirty low longitudinal ridges, those on the inner aspect of the coils being rather more prominent than the rest.

There is a very short buccal capsule (fig. 1, *b*), presenting a similar appearance to that of *Heligmosomoides polygyrus*, as figured by Boulenger (1922). The œsophagus measures 0.4 mm. in length in the male and 0.4–0.47 mm. in the female.

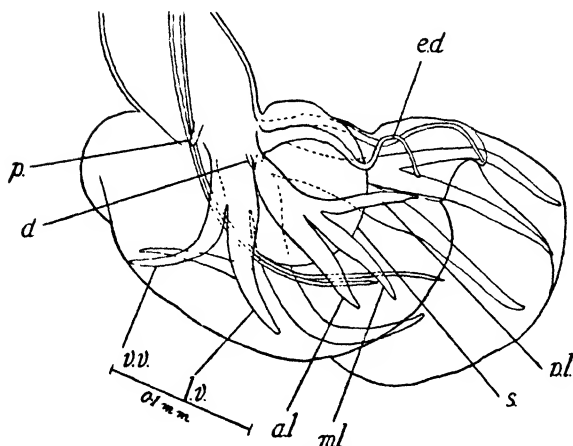
Fig. 1.



*Nematospiroides dubius.* Anterior end of female.

*b.*, buccal capsule.

Fig. 2.

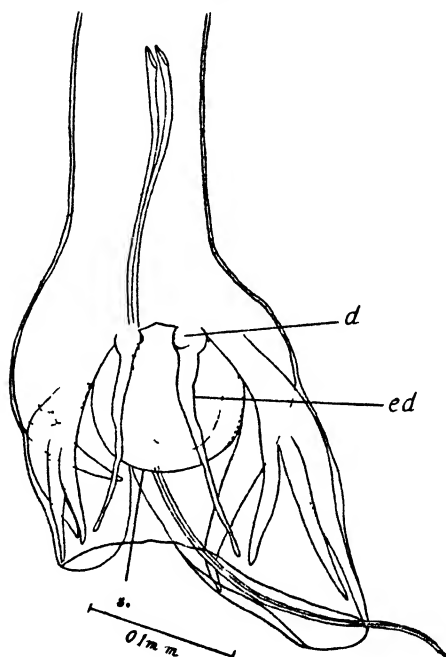


*Nematospiroides dubius.* Caudal end of male; lateral view.

*a.l.*, antero-lateral ray; *d.*, tubercle representing dorsal ray; *e.d.*, externo-dorsal ray; *l.v.*, latero-ventral ray; *m.l.*, medio-lateral ray; *p.*, prebursal papilla; *p.l.*, postero-lateral ray; *s.*, post-cloacal swelling; *v.v.*, ventro-ventral ray. (The paired structures lettered are those of the left side.)

The caudal end of the male is provided with a large bursa (figs. 2 & 3) produced latero-ventrally into two very unequal lobes. The right lobe is very much larger than the left, and its rays are much longer and stouter than those of the left lobe. There is no dorsal lobe, the posterior margin of the bursa on the dorsal side being almost straight, and not interrupted by any incision or indentation. All the vential and lateral rays originate from a large common trunk on each

Fig. 3.



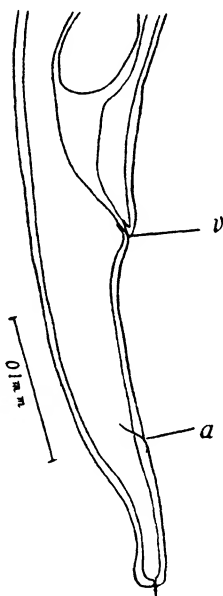
*Nematospirroides dubius*. Caudal end of male; dorsal view.

*d.*, tubercle representing right dorsal ray; *e.d.*, right externo-dorsal ray;  
*s.*, post-cloacal swelling.

side. This common trunk is primarily divided near its base into a thick ventral trunk and a more slender lateral trunk. The ventio-ventral and latero-ventral rays are strongly divergent from each other, the latter being considerably the stoutest of all the rays. The lateral trunk divides into an anterior branch consisting of the relatively stout antero-lateral ray alone, and a posterior branch which divides again

almost immediately into two rays—the medio-lateral and postero-lateral,—which are rather slender. The medio-lateral ray lies rather close to the antero-lateral, while the postero-lateral ray diverges widely from it. Near the bases of the main ventro-lateral trunks there originate separately two very long and relatively slender rays, which may be regarded as the externo-dorsal rays. These are considerably swollen at their bases and run out almost to the posterior margin of the bursa. Ventrally they give rise, from their swollen basal portions, to a pair of very short, blunt processes or papilliform

Fig. 4.



*Nematospiroides dubius*. Caudal end of female; lateral view.

a., anus; v., vulva.

tubercles. There is no dorsal ray in the usual median position, and it is suggested that these tubercles represent the two halves of the dorsal ray. There is a pair of well-developed prebursal papillæ, which appear to be situated within the bursa.

A large portion of the space enclosed by the bursal membrane is taken up by a relatively enormous balloon-like post-cloacal swelling (figs. 2 & 3, s.), almost spherical in shape. This appears to consist of a thin cuticular bladder filled with

granular matter. The spicules are slender and filiform, measuring 0.54–0.6 mm. in length. They are slightly expanded at their roots, and terminate distally in fine points. Throughout the greater part of their length the spicules are usually so closely apposed as to appear almost as if fused. No accessory piece has been discovered.

The caudal end of the female (fig. 4) is rather abruptly narrowed immediately behind the prominent vulva, which is situated at about 0.32 mm. from the posterior end. From this point the body tapers to form a blunt tail. The anus is situated on the tapering portion, at about 0.1 mm. from the extremity, and is quite inconspicuous. The tip of the tail is somewhat truncate, but carries a very slender, sharp, terminal spike measuring 0.01–0.013 mm. in length. Altogether the appearance of the caudal end is very much the same as in Boulenger's (1922) figure of *Heligmosomoides polygyrus*. The female genital tube is single, running anteriorly from the vulva. The eggs measure 0.075–0.09 × 0.043–0.058 mm., and appear to contain coiled embryos when laid.

The type-specimens are deposited in the British Museum (Natural History).

#### NEMATOSPIROIDES.

*Generic Diagnosis.*—*Heligmosominæ*. Body spirally coiled. Cuticle of head dilated and transversely striated. Cuticle of body with faint transverse striations and about thirty longitudinal ridges. Bursa entire, without dorsal lobe and with markedly asymmetrical lateral lobes, the right much larger than the left and with longer and stouter rays. Ventral rays strongly divergent at their extremities. Antero-lateral ray stout, leaving the main lateral stem nearer to its base than the other two lateral rays. Postero-lateral ray diverges widely from medio-lateral. Externo-dorsal rays originating separately, long and slender. Dorsal ray apparently represented by a pair of small "tubercles" originating from the ventral side of the bases of the externo-dorsal rays. Spicules simple, filiform, relatively long. Accessory piece apparently absent. Tail of female truncate, with a slender terminal spike.

*Hab.* Small intestine of Rodents.

*Genotype.* *N. dubius*, sp. n., from *Apodemus sylvaticus*.

#### DISCUSSION.

Dujardin (1845) described five species of "*Strongylus*" from various kinds of mice. His descriptions, unfortunately,

were not sufficiently detailed for modern systematic requirements—the precise arrangement of the rays of the bursa, for example, upon which the modern classification of this group so largely depends, was not described, and the species were not figured. So far as its description goes, one of these species—*Strongylus polygyrus*, from *Microtus* [*Arvicola*] *arvalis* and *Apodemus* [*Mus*] *sylvaticus*—seems to agree very closely with the species described in the present paper. But other authors have identified other parasites with it. V. Linstow (1878, 1879, 1882) gave a fuller account of a form which he believed to be *S. polygyrus*, Dujardin. Hall (1916), however, considered that v. Linstow's species could not be identified with Dujardin's *S. polygyrus*, and renamed it *linstowi*, transferring it to a new genus—*Heligmosomoides*. The species *polygyrus* of Dujardin was removed by Hall, following Travassos, to the genus *Viannia*. But Boulenger (1922), having examined material from *Microtus agrestis* in England, identified his species with *S. polygyrus*, Dujardin, and further identified v. Linstow's *S. polygyrus* with Dujardin's, placing this in Hall's genus *Heligmosomoides*. The position at present, therefore, is that *Strongylus polygyrus*, Dujardin, has become the type-species of *Heligmosomoides*. This has resulted from the assumption that Boulenger's material was really identical with Dujardin's species *polygyrus*. It is possible, however, that this was not the case, and it appears to the writer certainly not less probable that the species here named *Nematospiroides dubius* is actually Dujardin's *Strongylus polygyrus*. Certain points mentioned by Dujardin are in favour of this view:—

(1) The species was found by Dujardin "very abundantly" in the intestines of thirty or forty wood-mice (*Apodemus* [*Mus*] *sylvaticus*), as well as in *Microtus* [*Arvicola*] *arvalis*, in France. The latter species does not occur in England\*, and Boulenger's material came from *Microtus agrestis*.

(2) The body is said to be "fortement enroulé," forming a coil of five or six turns in the male and ten to eighteen turns in the female. This description closely fits the type-material of *N. dubius*. Boulenger only says of his material that the worms are "usually coiled in a spiral."

(3) Dujardin mentions having found some of the worms in pedunculated cysts on the outer surface of the intestine in *Microtus arvalis*.

The measurements given by the different describers of

\* For information on this point the writer is indebted to Mr. Oldfield Thomas, F.R.S., and Mr. M. A. C. Hinton.



"*S. polygyrus*" do not, unfortunately, when compared with those of *N. dubius*, provide any striking contrast which would help to decide this question of identity. The two species are evidently very similar in almost all their measurements, and either may be said to agree equally well with Dujardin's description, as the accompanying table shows (all measurements are given in millimetres).

In view of the insufficiency of Dujardin's description, and in order to avoid further confusion (pending a re-examination of the original material of *S. polygyrus*, if still in existence \*), it seems wisest to regard the form here described as a new species. In most respects it agrees fairly closely with the genus *Nematospiro*, according to the description of its genotype given by Walton (1923). In *N. turgida*, Walton, however, the asymmetry of the bursa is much less pronounced; the dorsal rays, although arising separately as offshoots from the bases of the externo-dorsal rays, are much better developed; prebursal papillæ are absent and an accessory piece is present. These differences are, perhaps, sufficient to justify the erection of the distinct genus *Nematospiroides*.

A list of the worm parasites found by Mr. Elton in the Oxford specimens of *Apodemus sylvaticus* may be of some interest. The forms identified up to the present by the writer are the following:—

#### NEMATODA.

*Syphacia obvelata* (Rud., 1802). Very abundant.

*Nematospiroides dubius*, gen. et sp. n. Abundant.

*Capillaria* ? *muris-sylvatici* (Dies., 1851). Observed once.

#### CESTODA.

*Tænia tæniæformis* (Batsch, 1786) (larval form, *Cysticercus fasciolaris*). Fairly common.

*Catenotænia pusilla* (Goeze, 1782) (adult). Fairly common.

*Hymenolepis* sp. (adult). Observed twice.

#### TREMATODA.

? "*Distoma*" *recurvum*, Duj., 1845. Observed twice.

#### REFERENCES.

- BOULENGER, C. L. 1922. "The Structure and Systematic Position of *Strongylus polygyrus*." *Parasitol.* xiv. 2, pp. 206-213.  
DUJARDIN, F. 1845. 'Histoire naturelle des Helminthes.' Paris.

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\* The types of almost all Dujardin's species appear to have been lost, and there is little hope of the discovery of those of *S. polygyrus*.

Name .....	<i>Strongylus polygyrus.</i>	<i>Strongylus polygyrus.</i>	<i>Helignasomoides polygyrus.</i>	<i>Nematospiroides dubius.</i>
Describer .....	Dujardin, 1845.	v. Linetow, 1878-9.	Boulenger, 1922.	Baylis, 1926.
Length .....	♂. 6.0-7.2      ♀. 10-13	♂. 4.0      ♀. 7.2	♂. 4.5-5.5      ♀. 6.2-10	♂. 6      ♀. 13
Maximum thickness .....	[ $\frac{1}{8}$ of length] 0.13-0.14	0.078      0.096	0.07-0.09      0.09-0.12	0.11      0.11-0.12
Diameter of "head" (with cuticle) ..	0.042      0.055	.....	0.04      0.05	0.033-0.036      0.04-0.043
" " (without cuticle)	0.024      0.027-0.032	.....	.....	0.023-0.028      0.03
Length of oesophagus .....	.....	.....	0.48-0.6	0.4      0.4-0.47
" spicules .....	0.58	0.540	0.5-0.58	0.54-0.6
" tail (female) .....	0.075	0.098	0.067-0.1	0.09-0.1
" caudal spike (female) ....	0.02	0.016	0.012-0.018	0.01-0.013
Vulva, distance from posterior end ..	0.3	0.24 *	0.24-0.35	0.32
Eggs, length .....	0.062-0.066	0.075	0.062-0.078	0.075-0.09
" width .....	.....	0.043	0.035-0.045	0.043-0.058

\* This measurement is stated to be from the *anterior* end, but this is doubtless due to a clerical error.

- HALL, M. C. 1916. "Nematode Parasites of Mammals of the Orders Rodentia, Lagomorpha, and Hyracoidea." Proc. U.S. Nat. Mus. l. pp. 1-258, pl. i.
- LINSTOW, O. VON. 1878. "Neue Beobachtungen an Helminthen." Arch. f. Naturg. xlv. i. pp. 218-245, pls. vii.-ix.
- . 1879. "Helminthologische Studien." *Ibid.* xlv. i. pp. 165-188, pls. xi., xii.
- . 1882. "Helminthologische Studien." *Ibid.* xlviii. ii. pp. 1-25, pls. i., ii.
- WALTON, A. C. 1923. "Some new and little-known Nematodes." Journ. Parasitol. x. 2, pp. 59-70, pls. vi., vii.

LIX. — *On the Names and Types of certain Pontian Antelopes.* By GUY E. PILGRIM, D.Sc., F.G.S., Geological Survey of India.

In a paper published in September 1926 entitled "Neue Caviicornia aus dem Pliocän von Samos" ('Palæontographica,' vol. lxxvii. part 6, pp. 135-175) Dr. Julius Andree has figured (pl. xvi. figs. 1, 6) the skull of a species of *Gazella*, to which he has given the name of *Gazella schlosseri*, sp. n. I wish to point out that this specific name is invalid, since it has been applied previously by Professor Marie Pavlow to a species of *Gazella* from Southern Russia which was described and figured by her in "Mammifères tertiaires de la Nouvelle Russie" (1913, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xvii. part 3). I therefore propose to replace it by the name *G. mytilinii*.

Although, as Dr. Andree has pointed out, a frontlet of the same species in the Munich Museum had been previously figured by Professor Max Schlosser in "Die fossilen Caviicornia von Samos" (1904, Beitr. Pal. Geol. Ost.-Ung. vol. xvii. pp. 21-118) under the name of *Gazella* sp., yet it is obvious that the type of the species *G. mytilinii* must be the skull in the museum at Vienna figured by Dr. Andree, and all the more so because it is an almost perfect skull, with the complete cheek-dentition.

A third frontlet of the same species exists in the British Museum in London. This was found in Samos by an unknown collector, and purchased by the Museum in 1894. This specimen it is intended to figure shortly in a British Museum publication, in which comparisons will be made with other known species of *Gazella*.

LX.—*A Comparative Study of the Otoliths of the Neopterygian Fishes* (continued).—Orders *Haplomi*, *Heteromi*, *Iniomi*, *Lyomeri*, *Hypostomides*, *Salmopercae*, *Synentognathi*, *Microcyprini*, *Solenichthyes*. By G. ALLAN FROST, F.L.S., F.G.S., F.Z.S.

[Plates XX. & XXI.]

In all the orders remaining to be described the sagitta is the principal otolith, and with few exceptions (e. g., *Esox*) the lapillus and asteriscus are diminutive, and usually microscopic.

#### IV. Order HAPLOMI.

In *Esox lucius* the sagitta (Pl. XX. fig. 1) resembles that of *Megalops cyprinoides*\* of the order Isospondyli, but is more highly specialized. The outer side is straight, with a wide longitudinal furrow; the inner side has a raised wing-like projection with radiating furrows above the cauda; this extends halfway to the dorsal rim, which is irregular, dentated, and has a postero-dorsal process; the ventral rim is serrated and slightly curved, passing into the posterior rim, which is rounded and slightly serrated. The anterior rim consists of a slender prominent rostrum dentated on the upper margin, resembling that of *Gonostoma* of the suborder Stomiatioidea, a large pointed antirostrum, and a deep triangular excisura, which extends nearly to the middle of the inner side of the otolith. The sulcus is divided by an angle of the lower line. The ostium is longer than the cauda, and occupies the upper margin of the rostrum, but differs from that of *Megalops* in that it does not quite extend to the point; the lower line of the cauda is curved, and has an upward inclination; generally it does not reach the posterior rim. The other otoliths are unusually well developed. The asteriscus (Pl. XX. fig. 2) is elongated and upright, and as high as the sagitta; the anterior rim is serrated. The lapillus (Pl. XX. fig. 3), which is stout and conchoidal in shape, is not quite two-thirds the height of the other otoliths.

In *Umbra crameri* the sagitta (Pl. XX. fig. 4) is large and is of the Salmonid type. It resembles that of *Salmo trutta*†, differing in the greater height of the dorsal rim, which is

\* Ann. & Mag. Nat. Hist. ser. 9, vol. xv. pl. xi. fig. 3 (1925).

† T. c. pl. xii. figs. 4, 5.

crenated, and in the irregular anterior rim, the more depressed ostium, and the strong median angle in the lower line of the sulcus.

It resembles that of *Esox* in the shape of the sulcus, in the upward inclination of the cauda, the median angle of the lower line, and in the presence of a præsulcal area; it differs in the shape of the rostrum, which is shorter and up-turned, in the smooth convex outer side, and in the absence of a lateral process of the inner side.

## V. Order HETEROMI.

In *Halosaurus macrochir* (Pl. XX. fig. 5) the sagitta is of the Elopine type, resembling that of *Elops* in the absence of an antirostrum and excisura, and that of *Megalops* in the rounded posterior rim. The sulcus is straight as in *Megalops*, but is considerably shortened, ending near the centre of the inner side of the otolith, which differs, however, in the rounded anterior rim and shorter rostrum.

In *Notocanthus sexspinis* (Pl. XX. fig. 6) the sagitta is elliptical and unusually thick; the outer side is convex and the inner side flat. The dorsal rim is curved; the ventral rim is straight, but is curved at its extremities, where it passes into the anterior and posterior rims. The posterior rim is rounded, and the anterior rim is irregular. There is no rostrum, antirostrum, or excisura. The sulcus resembles that of *Halosaurus* in its length and position, but differs in the shortness of the ostium and in the more distended cauda.

## VI. Order INIOMI\*.

In the order Iniomi the sagitta is large and well developed; the asteriscus and lapillus are generally microscopic and are not described.

The examples described of the sagitta may be divided into two types:—

1. The "Elopine" † as Part I.—e.g., *Aulopus*, *Saurus*, *Chlorophthalmus*, *Synodus*, *Ateleopus*.
2. The "*Scopelid*"—Distinguished by a heightening of the otolith, the reduction of the rostrum, and by the uniform width of the sulcus, in which the ostium is longer than the short and truncated cauda—e.g., Family Myctophidæ.

\* The families are taken in the order of Mr. Regan's classification (Ann. & Mag. Nat. Hist. ser. 8, vol. vii. p. 320, 1911).

† Ann. & Mag. Nat. Hist. ser. 9, vol. xv. p. 156 (1925).

## A. Suborder MYCTOPHOIDEA.

In *Aulopus filamentosus* (Pl. XX. fig. 7), of the family Aulopidae, the otolith is of the Elopine type, and also resembles that of *Osmerus* (Osmeridae). There is a wide upturned rostrum, and the sulcus opens on the anterior part of the dorsal rim; the cauda curves down and opens on the posterior rim. It differs from that of *Osmerus* in the straight dorsal rim, the more acute rostrum, and in the width and depression of the opening of the cauda.

In *Synodus lacerta* (Pl. XX. fig. 8), of the family Synodontidae, the sagitta resembles in general appearance that of *Megalops cyprinoides*\*, of the family Elopidae; it differs in the irregularity of the dorsal rim and in the cauda, which is irregularly curved and inclined ventrally. The point of the rostrum is upturned as in *Aulopus*, but the level of the upper margin is less than half the height of the otolith.

In *Synodus intermedius* (Pl. XX. fig. 9) the otolith resembles that of *Elops* in the straight rostrum and in the long curved cauda. It differs in the sharply truncated anterior part of the dorsal rim, which forms a right angle with the anterior rim; in the oblique posterior rim with the lower part inclined inwardly; and in the very slight curve of the ventral rim.

In *Synodus* sp. (Pl. XX. fig. 11) the otolith is markedly "Elopine," the shape being elongate and cuneiform. The dorsal rim is oblique and highest posteriorly, the ventral rim curved, and the posterior rim produced and rounded. There is a slender pointed rostrum, but no antirostrum or excisura. The sulcus is oblique and undivided, and opens on the dorsal rim at some distance from the point of the rostrum; the opening is constricted; the caudal end is rounded and does not approach the posterior rim.

In *Chlorophthalmus agassizii* (Pl. XX. fig. 10), of the family Sudidae, the otolith resembles that of *Synodus* in the oblique and undivided sulcus. It differs in the dorsal rim, which is straight and provided with some indentations, and in the anterior rim, which is rounded and without a rostrum. The sulcus opens on the anterior end of the dorsal rim. The rounded point of the posterior rim is somewhat higher than in *Synodus*.

The family Myctophidae are sharply differentiated in their otoliths from the other families of the order Iniomi, in which the Elopine characteristics are predominant.

\* Ann. & Mag. Nat. Hist. ser. 9, vol. xv. pl. xi. fig. 3 (1925).

In *Ceratoscopelus maderensis* (Pl. XX. fig. 12), however, we have a passage form from the "Elopine" to the more specialized "Scopelid" type. The shape is ovate; the outer side is convex with dorsal furrows, the inner side flat. The dorsal rim is high and domed, oblique anteriorly, and rounded at its junction with the posterior rim; the ventral rim is curved, passing into the anterior rim, and has a slight angle between it and the posterior rim, which is oblique and ventrally inclined inwards. The anterior rim consists of a prominent wide rostrum, without antirostrum or excisura. The sulcus is oblique; it opens on the anterior edge between the rostrum and the dorsal rim, leaving a wide præsulcal area; there is a strong anteriorly inclined angle of the lower line between the ostium and cauda. The ostium is of uniform width, and is wider and longer than the cauda, which is short, ovate, and with a rounded extremity which does not approach the posterior rim. Below the cauda is a shallow depression, the rim of which is well defined; in other species of the Myctophidæ this depression is incorporated in the sulcus, forming a double rim below the cauda.

In *Myctophum caninianus* (Pl. XX. fig. 13) the otolith resembles that of *Ceratoscopelus*, differing in the nearly circular shape, and shorter and broader rostrum; the posterior and ventral rims are symmetrical, with small median angles. In the examples examined the sulcus is not defined, and its position is indicated in the figure by dotted lines.

The otolith of *Lampanyctus crocodilus* (Pl. XX. fig. 14) resembles that of *Ceratoscopelus*, differing in the dorsal rim, which is high anteriorly and more produced, and in the presence of a small rounded antirostrum and a small excisura. The rostrum is blunt and longer than the antirostrum. The sulcus is horizontal, and the cauda has a double lower line.

In *Rhinoscopelus coccoi* (Pl. XX. fig. 15) the shape is ovate; the outer side is flat and the inner side slightly convex. The dorsal rim is slightly curved and of equal height anteriorly and posteriorly; the ventral rim is deep, the anterior part curved and passing into the anterior rim, the posterior oblique; the posterior rim is oblique, the lower part being produced; the anterior rim consists of rounded rostrum and antirostrum of equal dimensions; between them the rim is concave, but is without an excisura. The sulcus is wider than in *Lampanyctus*, and is of uniform width; the ostium opens on the middle of the anterior rim and is longer than the oblong cauda. In this species we have a typical

example of the "Scopelid" type. Many fossil forms resembling it occur in Eocene and Miocene formations.

In *Neoscopelus macrolepidotus* (Pl. XX. fig. 16) the otoliths are highly specialized. The shape is oblong; the outer side is convex and the inner side flat. The dorsal rim is straight and broken by deep and irregular indentations, and is rounded posteriorly; it forms an angle with the anterior rim, which is oblique and contains a deep triangular indentation. The ventral rim is oblique and deepest anteriorly; there is a deep indentation between it and the anterior rim. The posterior rim is concave with upper and lower rounded projections. The sulcus opens on the anterior half of the dorsal rim; it is curved, of uniform width, and is divided by an angle of the lower line; the cauda is rather longer than in the other Scopelid species, and is without a definite termination, becoming shallow and disappearing some distance from the posterior rim. The antero-dorsal point of the otolith forms a blunt rostrum; there is no antirostrum; an excisura is present behind the opening of the sulcus.

#### B. Suborder ALEPIDOSAUROIDEA.

The fishes of this suborder are comparatively rare, and it has so far been impossible to obtain examples for examination, with the exception of a poor example of *Alepidosaurus ferox*, in which, although the cranial cavity was very large, no otoliths were discernible.

#### C. Suborder ATELEOPOIDEA.

In *Ateleopus natalensis* (Pl. XX. fig. 17), of the family Ateleopidae, the otoliths of an example preserved in formalin were so corroded that it was impossible to remove them from the surrounding membranes, and only an outline of the form could be obtained. The otolith resembles in its general shape that of *Aulopus* (Pl. XX. fig. 7), but differs in the roundness of the anterior and posterior rims, and in the height of the posterior part of the dorsal rim.

### VII. Order LYOMERI.

Owing to the rarity of the species comprising the order Lyomeri, which is regarded by Mr. Tate Regan as possibly derived from the Iniomi\*, it has been impossible to examine the otoliths of these fishes.

\* Ann. & Mag. Nat. Hist. ser. 8, vol. x. p. 348 (1912).



## VIII. Order HYPOSTOMIDES.

This order comprises one family, the Pegasidæ.

In *Pegasus natans* (Pl. XX. fig. 18) the otolith is circular and the sides flat; in general shape it resembles those of the Myctophidæ, but differs in its greater height. There is a slight rounded rostrum, below which the anterior rim is concave; there is no antirostrum or excisura. The sulcus resembles in outline and in its position those of the Myctophidæ; it differs in being entirely enclosed and in the absence of an angle in the lower line; there is a slight angle of the upper line between the ostium and cauda, as in *Rhinoscopelus*.

## IX. Order SALMOPERCÆ.

The otoliths of the fishes of the order Salmopercæ closely resemble those of *Ophichthys gomesii*\* (Order Apodes): in his classification of this order Mr. Tate Regan† notes that it has been suggested by Jordan and Evermann that these fishes are related to the percoid families Percidæ and Centrarchidæ; Mr. Regan adds that this is not confirmed by a study of the anatomy, and the evidence of the otoliths supports his opinion. On the other hand, there is a strong resemblance of the otoliths to those of the percoid genus *Apogon*, which differ from the remainder of the Percoids in the sulcus. The type may be described as "Biovate," of which the distinguishing features are:—shape ovate, rostrum stout, antirostrum and excisura absent or slight, sulcus with median angles, ostium and cauda both ovate and of equal dimensions, end of cauda rounded, postcaudal area present.

In *Percopsis guttatus* (Pl. XX. fig. 20), of the family Percopsidæ, the sagitta resembles that of *Ophichthys gomesii*‡. The shape is ovate and biconvex; a rostrum and præsulcal area are developed, but no antirostrum or excisura. It differs in the sulcus, in which the ostium and cauda are both ovate and equal in size, and in the posterior rim, which has a single projection. The lapillus is square, and the asteriscus is drop-shaped; both are microscopic. In the specimen of *Columbia transmontana* (Pl. XX. fig. 21) examined the otoliths appear to be identical with those of *Percopsis*, the slight difference in the dorsal rim of the sagitta falling within the limits of variation observed in the otoliths of a single species.

In *Aphredoderus sayanus* (Pl. XX. fig. 19), of the family

\* Ann. & Mag. Nat. Hist. ser. 9, vol. xvii. pl. iv. fig. 12 (1926).

† Op. cit. ser. 8, vol. vii. p. 296 (1911).

‡ Op. cit. ser. 9, vol. xvii. fig. 12 (1926).

Aphredoderidæ, the otolith closely resembles that of *Ophichthys* in the rounded rostrum, in the præsulcal area, and in the distension of the ostium. It differs in the concavity of the dorsal rim, and in the presence of a depression in the dorsal area; there is also a slight antirostrum and excisura; the extension of the lower part of the posterior rim is wider and rounded, and the cauda is straighter and more ovate. There are strong angles in the upper and lower lines of the sulcus. The otoliths of this species are more strongly Apodal in type than those of *Percopsis* and *Columbia*, in which the divisions of the sulcus are equal in width.

### X. Order SYNENTOGNATHI.

In the order Synentognathi the sagitta is well developed, but the asteriscus and lapillus are microscopic. In those species described the sagitta is generally ovate, pointed anteriorly, and with the posterior rim rounded or obtuse. The pointed rostrum is generally upturned and with a slight præsulcal area. No antirostrum or excisura is present, an exception being in the case of *Belone annulata*, in which there is a slight excisura. Elopine and Clupeoid features prevail as a rule, while some species show resemblances to the forms of the orders Salmopercæ and Apodes. They may be divided into three types:—

- 1st. The Elopine—e. g., *Belone*.
- 2nd. The Clupeoid—e. g., *Chriodorus*, *Hemirhamphus far.*
- 3rd. The Biovate—e. g., *Tylosurus*.

#### A. Suborder SCOMBRESOCOIDEA.

In *Belone vulgaris*, of the family Belonidæ, the sagitta (Pl. XX. fig. 22) is of the Elopine type, the dorsal rim is slightly domed, the ventral rim is oblique and deepest posteriorly, the posterior rim is indented medianly, with the upper part rounded and produced; the anterior rim consists of an upturned rostrum, there is no antirostrum or excisura, but the upper margin of the rostrum is slightly hollowed. The sulcus is straight, but, owing to the depth of the oblique ventral rim posteriorly, gives the impression of being upwardly inclined. The ostium opens on the upper margin of the rostrum, a small præsulcal area being present; it is depressed and wider than the cauda, which is uniform in width, and with the end pointed and well removed from the posterior rim. There is no angle between the ostium and cauda.

In *Belone annulata* the sagitta (Pl. XX. fig. 23) resembles

that of *Belone vulgaris*. It differs in the posterior rim, the lower part of which is produced (the reverse being the case in *Belone vulgaris*), in the more curved ventral rim, and in the sulcus, which is undivided and uniform in width, with the opening of the ostium narrow and the cauda down-curved. There is a slight excisura.

In *Tylosurus crocodilus*, of the same family, the otolith (Pl. XX. fig. 24) resembles those of the Salmoperceæ, and is of the type referred to as Biovate. The shape is deeper than in the preceding species; the dorsal rim is curved and serrated, the ventral rim is curved and concave posteriorly, forming an angle with the posterior rim which has a median angle, below which it is oblique, and superiorly it is curved passing into the dorsal rim. The anterior rim is bluntly pointed and symmetrical, passing into the dorsal and ventral rims. The sulcus is horizontal, with a curved median depression of the upper margin; it is entirely enclosed, the ostial and caudal ends being rounded and some distance respectively from the anterior and posterior rims.

In *Scombresox saurus* the sagitta (Pl. XX. fig. 25) resembles that of *Tylosurus* in shape; it differs in the sulcus, which opens on the anterior rim and is irregular in shape, the end of the cauda being distended and with a slight downward direction.

#### B. Suborder EXOCETOIDÆ.

The otoliths of this suborder differ from those of the preceding species described. The shape is higher, and the sulcus in *Chriodorus* and *Hemirhamphus far* resembles closely that of the Clupeoid *Engraulis mystax*.

In *Chriodorus atherinoides*, of the family Hemirhamphidæ, the sagitta (Pl. XX. fig. 26) resembles that of *Engraulis mystax* of the order Isospondyli, in the high domed dorsal rim and in the peculiar formation of the sulcus; the ostium is large and depressed, it opens on the upper margin of the rostrum and there is an angle of the upper edge between it and the cauda, which is of the "bird's-head" type. It differs in the more up-turned rostrum, in the ventral rim which is curved anteriorly and is flattened in its median part, and in the posterior process which resembles that of the otolith of *Clupea harengus*.

In *Hemirhamphus far* (Pl. XXI. fig. 1), of the same family, the otolith resembles that of *Chriodorus* in the ventral rim, the anterior rim, and the sulcus. It differs in the irregular dorsal rim, in the concave posterior rim, and in the absence

of an upper angle to the sulcus. The cauda is of the "bird's-head" pattern, but the end is more downwardly directed, approaching that of *Albula vulpes* of the order Isospondyli.

In *Hemirhamphus intermedius* (Pl. XXI. fig. 2) the shape of the otolith resembles that of *Engraulis*; it differs from *Chriodorus* in the dorsal rim, which is higher and extends obliquely to the point of the rostrum, and posteriorly is curved, passing into the posterior rim, which is rounded; the sulcus is undivided and uniform in width; it opens on the point of the rostrum, is curved upwards, and does not reach the posterior rim.

In *Halocypselus evolans*, of the family Exocetidae, the sagitta (Pl. XXI. fig. 3) resembles the Apodal forms of *Moringua raitabona*\* and *Ophichthys gomesii*, and in a lesser degree the otoliths of the Salmopercae. It differs in the height of the upturned rostrum, the upper margin of which is only slightly below the level of the dorsal rim. The ventral rim is deepest anteriorly and is slightly serrated, and the posterior rim is produced and bluntly pointed. The sulcus opens on the upper margin of the rostrum, and there is a wide præsulcal area. The ostium has an upward inclination, there is a rounded angle of the upper margin where it joins the cauda, which is straight; the end is rounded and does not approach the posterior rim.

In *Exocetus* sp. (Pl. XXI. fig. 4) the shape is elongated, the dorsal rim is irregular, and the ventral rim resembles that of *Halocypselus*; the posterior rim is oblique and has the lower part produced; the anterior rim is pointed, the sulcal area occupying the rostrum. The sulcus opens on the anterior rim, and has an angle of the upper margin; the ostium is very small; the cauda is straight and wide, the lower line has a curved indentation, and the end which does not approach the posterior rim is rounded.

In *Cypsilurus nigripinnis* (Pl. XXI. fig. 5) the shape is high, the dorsal rim is highest anteriorly as in the Engraulidae, the ventral rim is curved and the posterior rim is rounded, and there is a slight angle at its junction with the dorsal rim. The anterior rim consists of a sharply projected rostrum. The sulcus is entirely enclosed, the ostium is narrow and ends about the level of the rostrum, the cauda has a downward inclination rising again to its termination, which is rounded, and does not approach the posterior rim.

\* Ann. & Mag. Nat. Hist. ser. 9, vol. xvii. pl. iv. figs. 9, 12.

## XI. Order MICROCYPRINI\*.

In the order Microcyprini the sagitta is large in proportion to the size of the fish (except in *Amblyopsis*). In the majority of the species examined the sagitta belongs to a type that may be described as "Microcyprinid" †, distinguished by the following features:—Otolith generally as high as long, the dorsal area shorter anteriorly and posteriorly than the ventral area (as in the Salmonidæ); sulcus horizontal, opening on the middle of the anterior rim, often divided by a median angle of the upper margin; end of cauda not reaching posterior rim. The asteriscus is well developed and about half the height of the sagitta; its position is upright and its form of the Characinid type, except in *Rivulus*, in which it is elongated and strongly Cyprinid. The lapillus is the smallest otolith, and is often microscopic; it has the form of a bean in many species, and resembles those of the Characinidæ and the primitive Cyprinid *Barilius*. In *Characodon* it is larger than in other members of the order and ovate in shape. In general, the smaller otoliths bear a strong resemblance to those of the Cyprinoidea, but in no case does the sagitta show any resemblance to the forms of this suborder.

## A. Suborder AMBLYOPSIDEA.

The otoliths of *Amblyopsis speleus*, of the family Amblyopsidæ, show no resemblance to those of the remainder of the order. The sagitta is very small, and the asteriscus and lapillus are indiscernible.

In the examples examined the two sagittæ differ, that of the left side having a postero-dorsal angle, which is absent in that of the right side. The shape is elongate and bi-convex; the outer side (Pl. XXI. fig. 14) is furrowed above the ventral rim, and there are ridges running to the extremities of the posterior rim; the inner side (Pl. XXI. fig. 15) is smooth. The dorsal and ventral rims are curved; the posterior rim is straight in the left otolith and rounded in that of the right side. The lower half of the anterior rim consists of a rostrum, and the upper half is curved, passing into the dorsal rim; there is no antirostrum or excisura. The sulcus opens on the rostrum; its course is ill-defined, but appears to run in close proximity to the ventral rim.

\* The arrangement of the families and subfamilies is taken from Mr. Regan's classification of the order (Ann. & Mag. Nat. Hist. ser. 8, vol. vii., 1911).

† *Amblyopsis* and *Anableps* are exceptions.

## B. Suborder PÆCILIOIDEA.

A single family—Cyprinodontidæ.

In *Cyprinodon fasciatus* (Pl. XXI. fig. 6), of the subfamily Cyprinodontinæ, the sagitta is typically "Microcyprinid." The shape is high and roughly circular, and both sides are flat; the dorsal area is shorter than the ventral area. The dorsal rim is curved and regular, passing into the anterior and posterior rims; the ventral rim is straight; the posterior rim is rounded; the anterior rim is concave. There is a rostrum and antirostrum, both of which are rounded. The sulcus is wide, straight, and undivided; it opens widely on the anterior rim, the end is rounded and does not reach the posterior rim. The anterior rim and the sulcus resembles those of aged examples of *Anguilla* \*.

In *Fundulus parvipinnis* (Pl. XXI. fig. 7), of the subfamily Fundulinæ, the sagitta is biconvex. It resembles that of *Cyprinodon* in the height of the otolith, in the straight sulcus, and in the shape of the ventral area; it differs in the narrow dorsal area and in the anterior rim, which is without an antirostrum and rises obliquely above the rostrum. The small dorsal rim has a median indentation, and the ventral rim, which is less regular than in *Cyprinodon*, is produced posteriorly. The posterior rim is oblique, with a median angle. The sulcus is horizontal and opens on the anterior rim; it resembles those of the Engraulidæ and certain species of the order Synentognathi, there is a median angle of the upper line and another angle above the ostium; the lower line is straight. The ostium is slightly longer than the domed cauda, the pointed extremity of which is level with the lower line of the sulcus.

In *Rivulus hartii* (Pl. XXI. fig. 8) the sagitta is large, circular, and biconvex, and resembles the "Scopelid" type. The dorsal area differs from those of the preceding species, being equal in extent to the ventral area. The dorsal rim is evenly rounded, passing into the anterior and posterior rims, which are regular except for a slight straightening of the lower part of the posterior rim; the ventral rim is curved and irregular, and there is a groove above it. The sulcus is straight, and opens by a small aperture on the middle of the anterior rim; there is a median angle of the lower line, and the end is blunt and well separated from the posterior rim. Rostrum, antirostrum, and excisura are scarcely indicated. The asteriscus (Pl. XXI. fig. 9) is strongly Cyprinid in shape,

\* Ann. & Mag. Nat. Hist. ser. 9, vol. xvii. pl. iv. fig. 2 (1926).

resembling that of *Rutilus* (Cyprinidæ), and the lapillus (Pl. XXI. fig. 10), which is about half the size of the asteriscus, resembles that of *Barilius*.

In *Haplochilus cameroonensis* (Pl. XXI. fig. 11) the sagitta is of the "Microcyprinid" type, and resembles that of *Fundulus*: it differs in the anterior extension of the dorsal area and in the anterior rim. There is a rounded rostrum, a rectangular antirostrum, and an excisura. The ventral area is deeper anteriorly than in *Fundulus* and *Cyprinodon*, and there is a ventral groove as in *Rivulus*. The sulcus is straight, undivided, and with a rounded end; it resembles that of *Cyprinodon*, but the upper line is straighter. The asteriscus (Pl. XXI. fig. 12) is of the high "Characinid" type and is half the height of the sagitta; the lapillus (Pl. XXI. fig. 13) is rectangular and is half the size of the asteriscus.

In *Orestias pentlandi*, of the subfamily Orestiinae, the sagitta, although distinctly of the Microcyprinid type, differs considerably from those of the foregoing species. The shape is high and somewhat triangular as in *Fundulus*; the outer side (Pl. XXI. fig. 25) is convex, with concentric lines, and the dorsal area is provided with radiating furrows. The inner side (Pl. XXI. fig. 26) is flat, with slight depressions above and below the sulcus. The dorsal rim is rounded, the ventral rim curved and regular. The posterior rim is oblique, with a slight median angle, and resembles that of *Fundulus*; it forms an angle with the ventral rim. The anterior rim consists of rounded rostrum and antirostrum as in *Cyprinodon*, but differs in the presence of a large triangular excisura.

The sulcus is undivided and opens widely on the sides of the excisura, the upper part consisting of a gentle depression of the dorsal area; it is wide anteriorly, and the lower line of the sulcus is straight and resembles that in *Cyprinodon* and *Fundulus*. The asteriscus (Pl. XXI. fig. 27) is nearly as high as the sagitta; the dorsal part is wider than the ventral. The lapillus (Pl. XXI. fig. 28) is of the Cyprinid bean-shape, as in *Rivulus* and *Jenynsia*, and is smaller than the asteriscus.

The sagitta of *Characodon variatus* (Pl. XXI. fig. 29), of the subfamily Characodontinae, differs from those of the preceding species principally in the diminished height of the otolith and in the peculiar formation of the ventral rim. The shape is roughly ovate—the outer side is flat and smooth, and the inner side convex. The dorsal rim is curved anteriorly, and posteriorly there is a projection forming an angle with the posterior rim; the ventral rim is irregular,

and has a large anterior concavity. The posterior rim resembles that of *Fundulus*, but the median angle is greater. The anterior rim resembles that of *Cyprinodon*, differing in the sharper angle of the antirostrum and in the greater projection of the rostrum; there is also a small angular excisura.

The sulcus in the specimen examined is ill-defined, but the upper line agrees with that in *Cyprinodon*. The otoliths differ in their relative sizes from those of the remainder of the Microcyprini. The asteriscus is microscopic; the lapillus (Pl. XXI. fig. 30), which is ovate and biconvex, is considerably larger than in the other species described, being about half the length of the sagitta.

In *Jenynsia maculata*, of the subfamily Jenynsiinæ, the sagitta (Pl. XXI. fig. 16) resembles in its proportions that of *Characodon*; the shape is elongated and biconvex. The dorsal rim is domed medianly, and is lower posteriorly and anteriorly; the ventral rim is slightly curved; the posterior rim is vertical, and forms right angles with the dorsal and ventral rims. The anterior rim consists of a rostrum and a shorter antirostrum, both of which are rounded; between them is a deep narrow excisura. There is an indentation of the lower part of the rostrum. The sulcus is horizontal and undivided; it is more curved than in the species previously described, and the end is pointed and slightly curved downward, resembling that in *Hemirhamphus far* of the order Synentognathi. The asteriscus (Pl. XXI. fig. 17) resembles the high Characinid type in the form of the sulcus, but the shape is different, the broad end being uppermost. The lapillus (Pl. XXI. fig. 11) is very small and bean-shaped as in *Hoplias* and *Barilius*, of the suborder Cyprinoidea.

In *Anableps tetraphthalmus*, of the subfamily Anablepsinæ, the sagitta (Pl. XXI. fig. 31) resembles the "Biovate" type, exemplified in the otoliths of the order Salmoperceæ, and also shows affinity with *Halocypselus*, of the order Synentognathi; it differs entirely from those of the remainder of the order Microcyprini. The shape is ovate and biconvex. The dorsal rim is curved and serrated; the ventral rim is irregular and indented anteriorly, the posterior rim is rounded, passing into the dorsal rim, and the lower part is oblique. The anterior rim consists of a broad prominent rostrum. There is a præsulcal area. The sulcus, which is constricted in the middle, extends from the upper margin of the rostrum across the otolith, and terminates close to the posterior rim. The ostium is upwardly inclined and of the same length as the cauda, which is ovate, and has a rounded



extremity. The otolith resembles closely those of the order Salmopercæ; it differs in minor details only, such as the larger rostrum, the serrations of the dorsal rim, the irregularity of the ventral rim, and the upward inclination of the ostium; it shows no affinity with the otoliths of the remainder of the Microcyprinids described.

In *Pœcilia vivipara*, of the subfamily Pœciliinæ, the sagitta (Pl. XXI. fig. 19) is of the Microcyprinid type. The shape is nearly circular; the outer side is convex and the inner side flat. It resembles the otoliths of *Fundulus* and *Haplochilus*. The rostrum is pointed, and there is a rounded antirostrum as in *Cyprinodon*; there is no excisura. It differs in the form of the posterior rim, which is rounded, and has an angular indentation below the junction with the dorsal rim; the ventral rim is also deeper and serrated. The sulcus resembles that of *Hemirhamphus* *far* of the order Synentognathi; the lower line is curved as in *Jenynsia*, but differs in the depression of the ostium and in the presence of an angle posterior to that of the upper line. The ostium opens on the upper part of the rostrum, and there is a præsulcal area; the cauda is domed above and inclined downwards. The asteriscus (Pl. XXI. fig. 20) is ovate and upright, and resembles those of the Gymnotidæ; it is three-fourths the height of the sagitta. The lapillus (Pl. XXI. fig. 21) is bean-shaped, resembling that of *Jenynsia*, but is of greater size.

In *Lebistes reticulatus* the sagitta (Pl. XXI. fig. 22) resembles that of *Cyprinodon*; it differs in the narrow dorsal area, the oblique posterior rim, and in the upper part of the anterior rim, which is oblique, the antirostrum being small and pointed. The ventral area of the otolith is symmetrical, being deeper anteriorly than in *Cyprinodon*. The sulcus resembles that of *Cyprinodon*, but differs in having slight median angles of the upper and lower lines. The asteriscus (Pl. XXI. fig. 23) is large and resembles that of *Jenynsia*; the lapillus (Pl. XXI. fig. 24) is ovate and very small.

It is of interest to note that in the Microcyprini the sagitta is generally extremely large in proportion to the size of the fishes, and in most cases the eyes are also large and well developed. In *Rivulus*, however, the sagitta is large, but the eyes are small: while in *Amblyopsis* the sagitta is diminutive, and the eyes are undeveloped.

## XII. Order SOLENICHTHYES.

In all the species of the order Solenichthyes the otoliths in the small examples examined were microscopic and in

most cases indiscernible. Those otoliths obtained are barely visible to the eye, and it is difficult to give a description of much more than the outline.

In *Aulostoma coloratum*, of the family Aulostomidæ, the sagitta (Pl. XXI. fig. 32) resembles the Anguillid type; the shape is elongated, the dorsal rim is regular and highest anteriorly; the ventral rim is regular and lightly curved; the lower part of the posterior rim is produced and rounded, the upper part is concave and forms an angle with the dorsal rim. The lower part of the anterior rim consists of a prominent rostrum, above which is an angle; the upper part is oblique and forms an angle with the dorsal rim. The sulcus is shallow and opens widely on the anterior rim. The asteriscus is relatively large, and the lapillus is diminutive.

In *Fistularia serrata* (Pl. XXI. fig. 33), of the family Fistulariæ, the sagitta resembles that of *Aulostoma*; it differs in the more elongate form, in the dorsal rim, which is straight and lower anteriorly, and in the sulcus, which is straight and more uniform in width.

In *Fistularia depressa* no otoliths were discernible in the small examples examined; this was also the case with *Macrorhamphus elevatus* and *Centriscus scutatus*.

In a large specimen of *Hippocampus*, of the family Sygnathidæ, the sagitta (Pl. XXI. fig. 34) and the asteriscus (Pl. XXI. fig. 35) were microscopic and could only be observed within the enclosing membranes. The shape of the sagitta is ovate, and resembles that of *Amblyopsis* of the order Microcyprini (Pl. XXI. fig. 15); the asteriscus is relatively large and pear-shaped in outline.

The sagitta of *Gastrotokeus biaculeatus* (Pl. XXI. fig. 36), of the same family, resembles that of *Anableps* (Microcyprini), and appears to be near the "Biovate" type, the sulcus having a median constriction. It differs in the anterior rim, which is truncated and without a rostrum.

#### SUMMARY.

1. The otoliths of the order Haplomi resemble those of the Isospondyli; in *Esox* they combine features occurring in *Megalops* of the family Elopidae, and in *Gonostoma* of the suborder Stomiatoidea; those of *Umbra* are of the Salmonid type.

2. In the order Heteromi the otoliths of *Halosaurus* resemble the Elopine forms, those of *Notacanthus* being more highly specialized, but agreeing with *Halosaurus* in the position and length of the sulcus.

3. The otoliths of the Iniomi may be divided into two types:—

- (i.) The "Elopine" (e. g., *Aulopus Saurus*, *Chlorophthalmus*, *Synodus*, *Ateleopus*).
- (ii.) The "Scopelid," distinguished by the following features:—Form ovate, rostrum present, with or without antirostrum and excisura; sulcus broad, straight, divided, and of uniform width; ostium opening on anterior rim and longer than cauda, which is short, ovate, or oblong, and often with a double lower line (e. g., family Myctophidæ; exceptions—*Ceratoscopelus*, a passage form from the Elopine type; and *Neoscopelus*, which is highly specialized).

4. The otoliths of the single species *Pegasus* of the order Hypostomides resemble the Scopelid type.

5. The otoliths of the order Salmopercæ resemble those of *Ophichthys gomesii* (Apodes); they differ in the form of the sulcus, in which the ostium and cauda are equal, giving rise to a type that may be described as *Biovate* distinguished by the division of the sulcus into two parts, which are ovate and more or less equal in size.

6. The otoliths of the Synentognathi generally resemble those of the suborder Clupeoidea of the order Isospondyli, some also showing an affinity with those of the orders Apodes and Salmopercæ. They may be divided into three types:—

- 1st. The Elopine, e. g., *Belone*.
- 2nd. The Clupeoid, e. g., *Chriodorus*, *Hemirhamphus*, *Cypsilurus*.
- 3rd. The Biovate, e. g., *Tylosurus*, *Scombrox*, *Holocypselus*, *Exocoetus*.

7. In the order Microcyprini the sagitta, in the majority of species examined, belongs to a specialized type which may be described as Microcyprinid, distinguished by the height of the otolith, which is often equal to the length, and by the narrow dorsal area. The sulcus in many cases resembles those of the otoliths of the Synentognathi, and in a lesser degree those of the Engraulidæ of the order Isospondyli, *Fundulus*, *Pæcilia*, *Jenynsia*. Exceptions are *Amblyopsis*, in which the otoliths show no resemblance to those of the remainder of the order; *Anableps* in which the sagitta is of the Biovate type, resembling those of the Salmopercæ, and *Rivulus* in which it is circular and resembles the "Scopelid."

form. The asteriscus resembles those of the Characinidæ in many cases, but the pointed margin is ventral instead of dorsal (e. g., *Haplochilus*). In *Rivulus* it is of the Cyprinid type, while in *Pœcilia* it is ovate, and resembles those of the Gymnotidæ. The lapillus is generally Characinid in type and as a rule microscopic; in *Characodon*, however, it is ovate and of considerable size. The general resemblance of the smaller otoliths to those of the suborder Cyprinoidea is offset by the large dimensions and specialized type of the sagitta, which shows no resemblance to those families of the Ostariophysi.

8. In the order Solenichthyes the otoliths are microscopic, and it has only been possible to describe a small number. There are two types:—

- (i.) The "Anguillid" (e. g., *Aulostoma*, *Fistularia*).
- (ii.) The "Biovate" (e. g., *Gastrotrokeus*).

In *Hippocampus* the sagitta resembles that of *Amblyopsis*, of the order Microcyprini.

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## EXPLANATION OF THE PLATES.

### PLATE XX.

#### Order HAPLOMI.

- Fig. 1. *Esor lucius* (sagitta),  $\times 2$ .
- Fig. 2. ——— (asteriscus).
- Fig. 3. ——— (lapillus).
- Fig. 4. *Umbra crameri* (sagitta),  $\times 5\frac{1}{2}$ .

#### Order HETEROMI.

- Fig. 5. *Halosaurus macrochir*,  $\times 7$ .
- Fig. 6. *Notocanthus seipinis*,  $\times 7$ .

#### Order INIOMI.

- Fig. 7. *Aulopus filamentosus*,  $\times 3\frac{1}{2}$ .
- Fig. 8. *Synodus lacerta*,  $\times 5$ .
- Fig. 9. *Synodus intermedius*,  $\times 5$ .
- Fig. 10. *Chlorophthalmus agassizii*,  $\times 3\frac{1}{2}$ .
- Fig. 11. *Synodus* sp.,  $\times 4\frac{1}{2}$ .
- Fig. 12. *Ceratospinelus maderensis*,  $\times 7$ .
- Fig. 13. *Myctophum caninianus*,  $\times 6$ .
- Fig. 14. *Lampanyctus crocodilus*,  $\times 3$ .
- Fig. 15. *Rhinoscopelus coccoi*,  $\times 7$ .
- Fig. 16. *Neoscopelus macrolepidotus*,  $\times 3$ .
- Fig. 17. *Ateleopus natalensis*,  $\times 4$ .

## Order HYPOSTOMIDES.

Fig. 18. *Pegasus natans*,  $\times 7$ .

## Order SALMOPERCÆ.

Fig. 19. *Aphredoderus sayanus*,  $\times 4$ .Fig. 20. *Percopsis guttatus* (sagitta),  $\times 4\frac{1}{2}$ .Fig. 21. *Columbia transmontana*,  $\times 3$ .

## Order SYNENTOGNATHI.

Fig. 22. *Belone vulgaris*,  $\times 3\frac{1}{2}$ .Fig. 23. *Belone annulata*,  $\times 2\frac{1}{2}$ .Fig. 24. *Tylosurus crocodilus*,  $\times 1\frac{1}{2}$ .Fig. 25. *Scombrex saurus*,  $\times 3$ .Fig. 26. *Chriodorus atherinoides*,  $\times 2\frac{1}{2}$ .

## PLATE XXI.

## Order SYNENTOGNATHI (continued).

Fig. 1. *Hemirhamphus far*,  $\times 2$ .Fig. 2. — *intermedius*,  $\times 2$ .Fig. 3. *Halocypselus evolans*,  $\times 2$ .Fig. 4. *Exocætus* sp.,  $\times 1\frac{1}{2}$ .Fig. 5. *Cypsilurus nigripinnis*,  $\times 3$ .

## Order MICROCYPRINI.

Fig. 6. *Cyprinodon fasciatus*,  $\times 12$ .Fig. 7. *Fundulus parvipinnis*,  $\times 5$ .Fig. 8. *Rivulus hartii* (sagitta),  $\times 5\frac{1}{2}$ .

Fig. 9. — — (asteriscus).

Fig. 10. — — (lapillus).

Fig. 11. *Haplochilus cameroonensis* (sagitta),  $\times 5$ .

Fig. 12. — — (asteriscus).

Fig. 13. — — (lapillus).

Fig. 14. *Amblyopsis spekeus* (sagitta, outer side),  $\times 7$ .

Fig. 15. — — (sagitta, inner side).

Fig. 16. *Jenynsia maculata* (sagitta),  $\times 5$ .

Fig. 17. — — (asteriscus).

Fig. 18. — — (lapillus).

Fig. 19. *Pæcilia vivipara* (sagitta),  $\times 5$ .

Fig. 20. — — (asteriscus).

Fig. 21. — — (lapillus).

Fig. 22. *Lebistes reticulatus* (sagitta),  $\times 5$ .

Fig. 23. — — (asteriscus).

Fig. 24. — — (lapillus).

Fig. 25. *Orestias pentlandi* (sagitta, outer side),  $\times 5$ .

Fig. 26. — — (sagitta, inner side).

Fig. 27. — — (asteriscus).

Fig. 28. — — (lapillus).

Fig. 29. *Characodon variatus* (sagitta),  $\times 5$ .

Fig. 30. — — (lapillus).

Fig. 31. *Anableps tetrophthalmus*,  $\times 5$ .

## Order SOLENICHTHYES.

Fig. 32. *Aulostoma coloratum*,  $\times 16$ .Fig. 33. *Fistularia serrata*,  $\times 8$ .Fig. 34. *Hippocampus* sp. (sagitta),  $\times 16$ .

Fig. 35. — — (asteriscus).

Fig. 36. *Gastroteus biaculeatus*,  $\times 16$ .

LXI.—A Comparative Study of the Otoliths of the Neopterygian Fishes (continued). By G. ALLAN FROST, F.L.S., F.G.S., F.Z.S.

[Plate XXII.]

### XIII. Order ANACANTHINI.

In the order Anacanthini the sagitta is large and well developed, and in most of the family Gadidæ is unusually long when compared with the size of the fish. The otoliths of certain members of the family Macruridæ resemble in form those of *Umbra crameri* of the order Haplomi; at the same time there is a strong resemblance in some otoliths of the Macruridæ to the more specialized forms of the order Apodes, and the spear-shaped cauda of many of the Gadidæ is similar to that occurring in the otoliths of other Apodal species.

Mr. Regan\* has drawn attention to the relationship existing between *Macruronus* of the family Macruridæ and *Merluccius* of the family Gadidæ; this is confirmed in a striking way by a comparison of the otoliths, which in both species are flat and leaf-shaped, differing from those of the remainder of the order, and agreeing also in the sulcus, which resembles that of *Anableps* of the order Microcyprini.

The sagitta of *Trachyrhynchus trachyrhynchus* (Pl. XXII. fig. 1) of the family Macruridæ resembles generally that of *Umbra crameri* of the order Haplomi, differing in the greater elevation of the point of the posterior rim and in the enclosed and undivided sulcus. It still more closely resembles the otolith of *Congromuræna* of the order Apodes, from which it differs in the irregularity of the dorsal rim and in the absence of a groove from the sulcus to the dorsal rim. The anterior part of the dorsal rim is also lower.

In *Macrurus* sp. (Pl. XXII. fig. 2) the sagitta resembles that of *Trachyrhynchus* in shape, but differs in the lower dorsal rim and in the more symmetrical rim, which has a median angle. It also differs in the form of the sulcus, which is divided and enclosed and of the Biovate type, resembling that of *Synaphobranchus*, a deep-sea species of the order Apodes; both ostium and cauda, which are ovate and of equal dimensions, enclose colliculi.

In *Macrurus cælorhynchus* (Pl. XXII. fig. 3) the otolith is nearer the Gadoid type and resembles that of *Gadus morrhua*.

\* Ann. & Mag. Nat. Hist. ser. 7, vol. xi. p. 462 (1903).

The shape is high and leaf-like, highest anteriorly and tapering posteriorly; the outer side is convex and has furrows on the dorsal part; the inner side is smooth and nearly flat. The serrated dorsal rim is high anteriorly and slopes to the rounded point of the posterior rim; the ventral rim is curved and regular, passing into the anterior rim, which is pointed and which has the upper part oblique and the lower part curved. The sulcus is straight and narrow, and opens on the upper part of the anterior rim; the ostium is shorter than the cauda, which is spear-shaped and pointed, and ends at some distance from the posterior rim.

The sagitta of *Macruronus nova-zeelandiae* (Macruridæ) is long and leaf-shaped, and very flat as compared with the species previously described. It is high anteriorly and tapering posteriorly as in *Macrurus colorhynchus*, but differs from this species in the lesser obliquity of the upper part of the anterior rim and in the length and flatness of the otolith. The outer side (Pl. XXII. fig. 4) is convex and heavily furrowed on the dorsal, ventral, and anterior rims, the furrows extending to a smooth longitudinal ridge. The inner side (Pl. XXII. fig. 5) is smooth and slightly convex. The dorsal rim is serrated, highest anteriorly, concave in its median part, and oblique posteriorly, forming an angle with the posterior rim, which is small and curved; the ventral rim is curved and serrated anteriorly; the anterior rim resembles that of *M. colorhynchus*, but the point is higher. The sulcus is biovate; it extends from the anterior point across the otolith, and becomes shallow and disappears close to the posterior rim; the ostium and cauda are equal and are separated by an angle of the lower margin.

In *Merluccius vulgaris* (Pl. XXII. fig. 6), of the family Gadidæ, the sagitta resembles that of *Macruronus*, the shape being long and leaf-like and the otolith thin and flat in appearance. It differs in the absence of furrows on the outer side; in the anterior rim, which is curved and produced in the ventral part and is strongly serrated; in the more symmetrical posterior rim; and in the dorsal rim, which is more rounded anteriorly and posteriorly is denticulated, the denticulations extending in some cases to the upper margin of the cauda. The sulcus is divided by angles of the upper and lower margins; the ostium is shorter than the cauda and does not reach the anterior rim; the cauda is usually distended and spear-shaped as in the Apodal forms *Ophichthys boro* and *Muraena augusti*\*, the end is narrowed

\* Ann. & Mag. Nat. Hist. ser. 9, vol. xvii. pl. iv. figs. 13, 16 (1926).

and rounded, or may become shallow, disappearing some distance from the posterior point of the otolith. The lapillus is minute and triangular, and the asteriscus is frail, triangular, and with a ventral process.

The sagitta in *Lota vulgaris* (Pl. XXII. fig. 7) is elongated and pointed anteriorly and posteriorly; the dorsal rim is domed and serrated, the ventral rim is slightly concave, the posterior rim is pointed and serrated, and the anterior rim is irregular. The sulcus resembles that of *Merluccius*, but is without an upper angle.

In *Gadus aeglefinus* (Pl. XXII. fig. 8) the sagitta is elongated, of even height, and is pointed posteriorly. The outer side is curved and has the dorsal part hollowed; there are dorsal, ventral, and anterior furrows, and a median longitudinal ridge which is more or less umbonated; the surface is hard and enamel-like. The inner side is convex and striated vertically above the sulcus, below which is a smooth ridge to which striations extend from the ventral rim. The dorsal and ventral rims are regular, and the posterior rim is pointed; the anterior rim is oblique, forming angles with the dorsal and ventral rims. The sulcus is enclosed, and is divided by an angle of the lower margin; it is filled in with dull material. The ostium is ovate and is half the length of the cauda, which is distended and tapered at the end, extending to the posterior point of the otolith. The lapillus is diminutive and conchoidal in shape, the asteriscus is also small and frail; it consists of two equal wings, and resembles a minute butterfly.

The sagitta of *Gadus virens* (Pl. XXII. fig. 9) resembles that of *G. aeglefinus*. It differs in the duller texture and smoothness of the surface of the outer side, in the greater curvature of the otolith, and in the unequal distension of the cauda. The ventral rim is also less regular, and the posterior rim less symmetrical. The serrations, if present, are very slight, and there are no striations of the inner side.

In *Gadus pollachius* (Pl. XXII. fig. 10) the sagitta resembles that of *G. virens*. It differs in the outer side, which has a brighter surface, and is furrowed and umbonated as in *G. aeglefinus*; in the less distended cauda; and in the presence of serrations of the ventral rim. The lapillus is of the usual conchoidal form, and the asteriscus resembles that of *Merluccius*.

The otoliths of the three last-described species are so similar that they are difficult to determine without considerable experience. The points to note are:—In *G. aeglefinus* the regularity of the dorsal and ventral rims, the



symmetry of the cauda, and the hard enamel-like surface of the otolith. In *G. virens* the greater curvature of the otolith, the slight concavity of the ventral rim, the distorted appearance of the posterior part caused by the irregular distension of the cauda, and the dull porcellaneous smooth surface of the otolith. *G. pollachius* differs from *G. virens* (which it otherwise resembles) in the less distended and contorted cauda and in the furrowing of the outer side, in which it more nearly approaches *G. aeglefinus*. The surface also appears harder and brighter, though less so than in *G. aeglefinus*.

In *Gadus merlangus* (Pl. XXII. fig. 11) the sagitta resembles that of *Merluccius*, but differs in the lower height of the anterior and the extreme attenuation of the posterior part, which is extended and pointed. It is also slightly more curved in its length. The outer side is concave and in young examples umbonated; in adult examples it is smoother, with slight vertical furrows, the surface being bright and enamel-like. The inner side is convex, and has a dull surface with striations from the dorsal rim to the sulcus, below which is a smooth band with a ventral groove, to which striations from the ventral rim extend. The dorsal rim is straight or slightly curved in the anterior half; posteriorly it slopes to the posterior point of the otolith, and on this part there are denticulations as in *Merluccius*. The ventral rim in young examples is curved and serrated, in adult forms it is straightened and regular; the anterior rim is oblique or rounded and has some serrations. The posterior of the otolith is narrow and pointed. The sulcus is straight, enclosed, and divided by an angle of the lower margin. The ostium is ovate and small; the cauda, which is two and a half times the length of the ostium, is sword-shaped and pointed, and ends near the posterior point of the otolith.

In *Gadus poutassou* (Pl. XXII. fig. 12) the sagitta resembles in shape that of young examples of *G. merlangus*, but the posterior of the otolith is less produced. The anterior half of the outer side is convex, there is a slight median concavity of the dorsal area, and the posterior point has a slight outward curve; the inner side is convex, and the surfaces of both sides are dull in appearance, smooth, and without furrows. The dorsal rim is straight anteriorly and inclined posteriorly as in *G. merlangus*; the ventral rim is curved, passing into the anterior rim, which is rounded; the posterior of the otolith is pointed, but less acutely than in *G. merlangus*. The sulcus is straight and undivided, and the cauda is slightly wider than the ostium.

In *Gadus minutus* (Pl. XXII. fig. 13) the shape is roughly triangular, the anterior part being deep and the posterior sharply pointed. The outer side is umbonated, the umbonations continuing on the curved posterior point, which bends outwards; the inner side is convex and without furrows. All the rims are serrated. The sulcus resembles that of *G. pollachius*.

The sagitta of *Gadus luscus* (Pl. XXII. figs. 14, 15) resembles that of *G. minutus*; it differs in its stouter and coarser appearance, and in the stronger curve of the otolith. In this species the umbonations of the outer side do not extend on to the curved posterior point. The inner side is extremely convex, and the sulcus resembles that of *G. virens*.

In *Phycis blennoides* (Pl. XXII. fig. 16) the sagitta resembles that of *Gadus poutassou*, but differs in the irregularity of its contour. The outer side is straight, and there is a rounded longitudinal ridge. The inner side is convex, and both sides are smooth, without striations, and dull in appearance. The dorsal rim is slightly concave, the ventral rim is curved and with irregular serrations, the posterior rim is obtusely pointed, and the anterior rim is oblique. The sulcus is curved and undivided, and extends the whole length of the otolith; the cauda has an upward distension of the upper margin, and resembles that of *Ophichthys boro* of the order Apodes.

The otoliths of young examples of *Gadus morrhua* resemble those of *G. aeglefinus*, but in those from adult fishes the shape is higher anteriorly, the posterior rim is less pointed, and at all stages the serrations of the rims and the furrows and ridges are more developed. The outer side (Pl. XXII. fig. 17) is concave, and strong ribs extend from the dorsal, ventral, and in some cases from the anterior rim, to a median longitudinal depression, containing (usually) a series of umbonations. The dorsal rim is high anteriorly, and curves downwards to the posterior point of the otolith, which is more rounded than in *G. aeglefinus*, and is strongly serrated; the ventral rim is curved and serrated; the anterior rim is oblique and serrated, and slightly more curved than in *G. aeglefinus*. The inner side (Pl. XXII. fig. 18) resembles that of the latter species, but is more convex, and the smooth ridge below the sulcus is usually rather wider and more prominent. The sulcus is curved, of uniform width, and is filled with dull material; it extends from the anterior to the posterior rim, and has an angle of the lower margin; the ostium usually is half the length of the cauda, which is often bisected by a vertical or oblique groove. The form of the sagitta is very variable in

being short and squat, and others long and the difference apparently being due to the rapid or retarded growth of the fish. The asteriscus (Pl. XXII. fig. 19) is of the butterfly form as in *G. æglefinus*, but one wing is smaller than the other. The lapillus (Pl. XXII. fig. 20) resembles that of *G. æglefinus*.

In *Molva vulgaris* (Pl. XXII. fig. 21) the sagitta differs from those of the preceding species of the Gadidæ; the shape is elongate and irregular, the outer side is concave, the anterior and posterior parts curve outwards, and the median part of the ventral area is depressed. The inner side is convex, and the dorsal area has vertical striations extending to the sulcus. The dorsal rim is curved and serrated; the ventral rim is concave medianly and curved posteriorly, passing into the posterior rim, which consists of an upwardly inclined process, on the dorsal side of which the cauda opens, the anterior rim is bluntly pointed and forms an angle with the ventral rim. The sulcus is deep and hollow, differing from those in other Gadoid otoliths in which it is filled in; it is divided by a constriction, but is without angles. The ostium opens on the upper part of the anterior rim; the cauda is longer than the ostium and opens on the dorsal margin of the upturned posterior process.

In *Motella mustela* (Pl. XXII. fig. 23) the sagitta resembles that of *Molva* in the general shape, and in the sulcus, the cauda of which opens in the same way above the posterior projection. It differs in the slighter curvature of the otolith, in the lower height of the dorsal rim, the more regular ventral rim, and the more symmetrical posterior rim. There is an excisura of the anterior rim. The sulcus has a median constriction, and the ostium and cauda are equal in length.

The sagitta of *Raniceps raninus* (Pl. XXII. fig. 22) is ovate in shape, the outer side is flat and the inner side convex. The dorsal rim is domed, the ventral rim curved, the anterior rim rounded, and the posterior rim bluntly pointed. The sulcus is of the Biovate type, and is divided by a band which connects the dorsal and ventral areas. The ostium extends to the upper part of the anterior rim, and is ovate, deep, and partly occupied by a colliculum; the cauda is ovate and shallow, and does not reach the posterior rim.

The otoliths of *Physiculus bacchus* (Pl. XXII. fig. 24) are highly specialized and show little resemblance to those of the remainder of the Gadidæ. The shape is irregular; the outer side is umbonated and the inner side convex. The dorsal rim is irregular; it is high anteriorly and in its

median part, and inclined and serrated posteriorly. The ventral rim is curved and regular. The posterior rim is produced and consists of three pointed projections. The upper part of the anterior rim is oblique and the lower part consists of a prominent rostrum. The sulcus is divided by a median band, which connects the dorsal and ventral areas as in *Raniceps*. The ostium has a rounded posterior depression, from which it extends forward upon the rostrum, from the lower part of which a groove extends backwards; the cauda consists of two deep grooves, which open on the posterior rim above and below the middle of the three pointed processes which form the rear of the otolith. The otoliths of this species are specially noticeable for the peculiar formation of the cauda, and have their prototype in a fossil form described by me from the Miocene, Oamuru series, from Pukeuri, New Zealand\*.

#### SUMMARY

1. The otoliths of some Macruridæ resemble those of *Umbra* of the order Haplomi, and also the more specialized forms of the order Apodes; others (e. g., *M. cælorhynchus* and *Macruronus*) have otoliths of the Gadoid type.

2. The otoliths of the Gadidæ are highly specialized; they are generally distinguished by the height of the anterior part and the tapering and pointed posterior part, by the enclosed ostium, and by the long cauda, which is often spear-shaped and resembles that of the Apodal forms *Ophichthys boro* and *Muraena augusti*.

3. The close relationship of the Macruridæ and Gadidæ are shown by the resemblances between the otoliths of *Macrurus* sp. and *Raniceps*, *Macrurus cælorhynchus* and *Gadus morrhua*, and especially between *Macruronus* and *Merluccius*.

4. Aberrant otoliths are those of *Molva*, *Motella*, and *Physiculus*.

I wish to acknowledge, with many thanks, the use of material kindly supplied by the British Museum (Nat. Hist.), South Kensington, and the help I have received from Mr. C. Tate Regan, F.R.S., and Mr. J. R. Norman in the preparation of the foregoing paper.

\* Trans. New Zeal. Inst. vol. lv. p. 607 (1924).

## EXPLANATION OF PLATE XXII.

## Order ANACANTHINI.

- Fig. 1. *Trachyrhynchus trachyrhynchus*,  $1 \times 1$ .  
 Fig. 2. *Macrurus* sp.,  $\times 2$ .  
 Fig. 3. — *cælorhynchus*,  $\times 1\frac{1}{2}$ .  
 Fig. 4. *Macruronus novæ-zeelandiæ* (outer side),  $\times 2$ .  
 Fig. 5. — — — (inner side).  
 Fig. 6. *Merluccius vulgaris*,  $\times 1$ .  
 Fig. 7. *Lota vulgaris*,  $\times 1\frac{1}{2}$ .  
 Fig. 8. *Gadus æglefinus*,  $\times 1$ .  
 Fig. 9. — *virens*,  $\times 1$ .  
 Fig. 10. — *pollachius*,  $\times 1$ .  
 Fig. 11. — *merlangus*,  $\times 1$ .  
 Fig. 12. — *poutassou*,  $\times 1\frac{1}{2}$ .  
 Fig. 13. — *minutus*,  $\times 2$ .  
 Fig. 14. — *luscus* (outer side),  $\times 1\frac{1}{2}$ .  
 Fig. 15. — — — (inner side).  
 Fig. 16. *Phycis blennoides*,  $\times 1$ .  
 Fig. 17. *Gadus morrhua* (outer side),  $\times 1$ .  
 Fig. 18. — — — (inner side).  
 Fig. 19. — — — (asteriscus),  $\times 2\frac{1}{2}$ .  
 Fig. 20. — — — (lapillus),  $\times 2\frac{1}{2}$ .  
 Fig. 21. *Molva vulgaris*,  $\times 1$ .  
 Fig. 22. *Raniceps raninus*,  $\times 1$ .  
 Fig. 23. *Motella mustela*,  $\times 6$ .  
 Fig. 24. *Physiculus bacchus*,  $\times 1\frac{1}{4}$ .

LXII.—Two new *Helicoid Snails* from the Mohave Desert.

By S. STILLMAN BERRY, Redlands, California.

DURING a recent brief collecting-trip into the Mohave Desert undertaken by Professor Archibald W. Bell and the writer, specimens of two species of land-snails were taken, both of which appear to belong to races not yet described. Appropriate diagnoses are accordingly offered below.

*Helminthoglypta graniticola*, sp. n. (Figs. 1 & 2.)

*Description*.—Shell thin, rather small, moderately elevated; whorls convex, the body-whorl quite tumid above the periphery; sutures strongly grooved out; last whorl but little descending. Aperture rounded, moderately oblique. Peristome reflected slightly at its posterior edge, but not sufficiently to more than barely indent the umbilicus, otherwise hardly at all thickened or expanded. Umbilicus permeable to apex, but rather narrow, contained from  $7\frac{1}{2}$  to 9 times in the diameter of the shell.

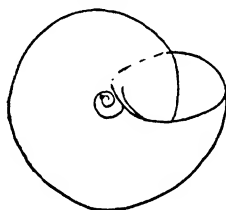
Spiral sculpture wanting, but almost the entire surface of the shell weakly papillose under high power, the papillæ sometimes exceedingly faint and difficult to make out, but in other cases distinctly visible by transmitted light; papillæ copious in number, but generally distinct and not confluent.

Periostracum thin, near Ridgway's Tawny Olive in colour on fresh empty shells, but paling to a lighter tone on the lower surface and on the spire, with a narrow, often inconspicuous band of Snuff Brown circumventing the shell just above the periphery. Living shells show a large patch of Andover Green and Deep Slate Olive on the base where certain portions of the animal show through. Such shells also show a more greenish cast on the spire, and are darker than cleaned specimens.

Fig. 1.



Fig. 2.



*Helminthoglypta graniticola*, sp. n.

**Measurements.**—Caliper measurements of five mature specimens are as follows:—

	Maximum diameter. mm.	Minimum diameter. mm.	Altitude. mm.	Diameter of umbilicus. mm.	Number of whorls.
Paratype..	15.5	13.3	9.5	2.1	5½
Type ....	15.0	12.8	8.6	1.8	5½
Paratype..	14.8	12.6	9.3	2.0	5½
Paratype..	14.6	12.5	8.8	1.7	5½
Paratype..	13.7	12.1	8.4	1.5	5

**Type.**—Cat. No. 6157 of the author's collection. Paratypes No. 6158 of the same collection; others to be deposited in the collections of Mr. Allyn G. Smith and the Academy of Natural Sciences of Philadelphia.

**Type-locality.**—North slope of isolated hill just south of Stewart Substation of Southern Sierras Power Company, south-east of Victorville, San Bernardino County, California; 2 living adults, 3 living juvenals, 40 dead and for the most part badly bleached shells, found on a steep slope among

*and Snails from the Mohave Desert.*

granite boulders and under dead vegetation in crevices between the larger rocks; June 11th, 1926.

*Remarks.*—This little species seems more nearly comparable to the typical form of *H. cuyamacensis*, Bartsch, than to any other hitherto described species known to me, but it amply differs through its very much smaller size and finer, more even pustulation. It was anticipated that the Mohave Desert would yield species of *Eremarionta*, the desert subgenus of *Micrarionta*, Ancey, rather than members of the group to which the present form is herein referred, but whereas the dead and bleached shells do recall *Eremarionta* to some extent, living ones have more the texture, aspect, and sculpturing of the montane *Helminthoglyptas*, and we find this disposition of them borne out by certain peculiarities of distribution, which will be dwelt upon more fully on a later occasion. Therefore, although the anatomy of these Mohave forms may, when investigated, tell a quite different story, it seems best just now to leave them in *Helminthoglypta* alongside the aforesaid *cuyamacensis*.

Besides the series from the typical locality we collected some numbers of specimens at various stations to the south-eastward in the neighbouring Granite Mountains, always in entirely similar situations. The blazing hot habitat which this species affects is indeed unusual for a member of the *Helminthoglypta* group, but would occasion little remark were the species considered an *Eremarionta*.

*Helminthoglypta mohaveana*, sp. n. (Figs. 3 & 4.)

*Description.*—Shell of fair size and thickness, moderately depressed; whorls convex, sutures distinct; last whorl de-

Fig. 3.

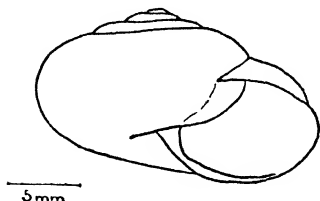
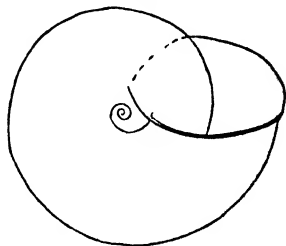


Fig. 4.



*Helminthoglypta mohaveana*, sp. n.

scending for a distance of 8 mm. or more back of the aperture, the latter consequently very oblique. Peristome slightly but distinctly thickened and expanded, usually reflected at the columellar junction so as to partly cover the umbilicus.

Umbilicus funicular, and of but moderate width, although permeable to the apex, being contained about  $7\frac{1}{2}$  or 8 times in the diameter of the shell.

Spiral sculpture wanting, but practically the entire surface of the shell both above and below very minutely and microscopically papillose, the papillæ best seen under fairly high magnification by transmitted light.

Such traces as persist indicate a light brown periostracum in life, and a narrow, possibly nearly obscure, brown band encircling the shell just above the periphery.

*Measurements.*—Caliper measurements of five mature specimens are as follows :—

	Maximum diameter. mm.	Minimum diameter. mm.	Altitude. mm.	Diameter of umbilicus. mm.	Number of whorls.
Paratype..	19.4	16.1	11.2	2.4	$5\frac{1}{4}$
Type ....	19.2	15.8	11.4	2.6	$5\frac{1}{2}$
Paratype..	18.4	15.4	11.1	2.4	$5\frac{1}{2}$
Paratype..	17.6	15.3	11.1	2.5	$5\frac{1}{4}$
Paratype..	16.5	13.8	10.2	2.0	5

*Type.*—Cat. No. 6155 of the author's collection. Paratypes No. 6156 of the same collection ; others to be deposited in the collections of Mr. Allyn G. Smith and the Academy of Natural Sciences of Philadelphia.

*Type-locality.*—Victorville grade, east side Victor Mountains, San Bernardino County, California ; 6 mature and 8 juvenile shells, all dead and bleached, collected among granite boulders on a hot steep slope ; June 11th, 1926.

*Remarks.*—This species shows evident relationship to the one just described, but is several times its bulk, besides being a heavier shell with a better-developed peristome and a more depressed aperture. The shell is flatter, with less tumid whorls, and the papillose sculpturing seems to be stronger and more regularly developed. The arid desert floor effectually isolates the habitats of the two forms one from the other.

### LXIII.—A new Lizard from New Caledonia.

By H. W. PARKER, B.A.

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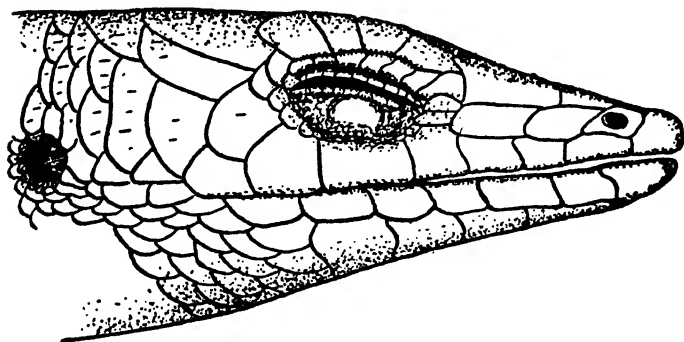
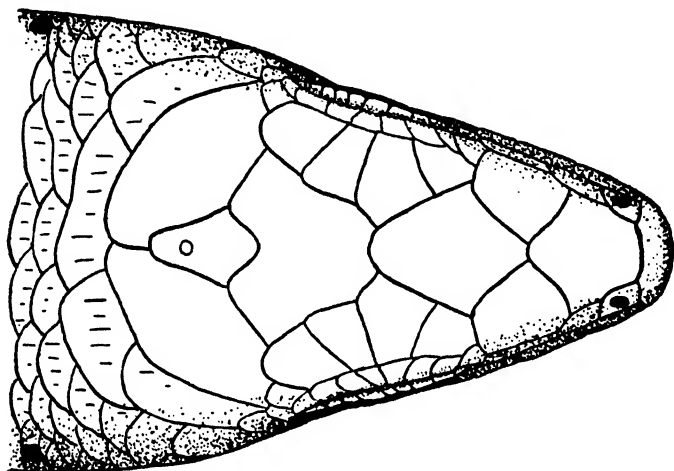
THE lizard described below formed part of the large collection of reptiles made in 1914 by the late Mr. P. D. Montague. The majority of the specimens in the collection call for no comment, but agree with the conclusions reached by Roux in



his work on the herpetology of New Caledonia. A selection from the collection has been generously presented to the British Museum by the University Museum of Zoology, Cambridge.

*Lygosoma (Leiolepisma) novæ-caledoniæ*, sp. n.

Type-specimen a ♀, number 1926. 9. 17. 1 in the British Museum, from the Upper Houailou River, New Caledonia.



*Lygosoma (Leiolepisma) novæ-caledoniæ*, sp. n.

The field-note attached to the specimen reads :—"Beaten from tree, 5. 8. '14."

Habit lacertiform; the distance between the end of the snout and the fore limb is contained once and a half in the distance between axilla and groin. Snout long, subconical, twice as long as the diameter of the eye. Nostril pierced in the nasal; no supranasal, fronto-nasal almost as long as broad (9:10), forming a broad suture with the rostral and narrowly in contact with the frontal; frontal longer than broad, longer than the single fronto-parietal and in contact with the two anterior supraoculars; four supraoculars, second largest; eight supraciliaries, a small interparietal, behind which the parietals form a suture; a pair of nuchals and a pair of temporals border the parietals; seven upper labials, the fifth largest and entering the orbit; postnasal and loreal elongate, twice as long as deep; ear-opening round, about as large as the transparent palpebral disc, with a single large projecting lobule anteriorly. 32 scales round the middle of the body, the dorsals and laterals with 3 to 5 feeble keels. Preanals not enlarged. The hind limb reaches the wrist when the limbs are adpressed. Digits cylindrical; subdigital lamellæ smooth, 22 under the fourth toe. Tail twice and one-fifth the length of head and body.

*Colour in spirit.*—Uniform bronzy above, shading to copper on the flanks; an irregular lighter area on each side of the base of the tail. White beneath, with small copper-coloured spots which are more numerous posteriorly and on the under surface of the tail, where they show a tendency to form irregular transverse bars.

	mm.
Total length .....	195
Head .....	13
Width of head .....	9
Fore limb .....	17
Hind limb .....	24
Tail .....	134

The number of subdigital lamellæ and scales round the middle of the body, the single fronto-parietal, the feebly carinate dorsal scales, and the presence of nuchal plates and auricular lobules would appear to indicate relationship with *Lygosoma* (*Leiolepisma*) *austro-caledonicum*, Bavay. From this species, however, the new one is readily distinguishable by its much longer snout (and consequently differently proportioned head-shields), larger size, longer tail, and coloration.

LXIV.—*Exotic Muscaridæ (Diptera)*.—XIX. By J. R. MALLOCH, Bureau of Biological Survey, Washington, D.C.

### Family Calliphoridae.

#### Subfamily RHINIINÆ.

This subfamily is distinguished from others in the family by the presence of a series of hairs or bristles on the upper posterior side of the basal section of the radius, the presence of but two sternopleural bristles (1 + 1), lack of hairs on the small knob-like protuberance below and a little in front of base of wing, and the bare disc of lower calyptra. First vein never prominently haired; supraspiracular convexity of metathorax never distinctly haired; lower calyptra not truncate apically, generally rather narrow.

In the subfamily as treated by Townsend \* I find two well-differentiated groups, each of which may be considered as entitled to tribal rank, the exact status being dependent upon the opinion of the individual worker, until a consensus of qualified authorities finally decides the matter. Townsend attempted a major grouping of his genera upon the structure of the epistome, dividing them into two segregates on whether this was "*Rhinia*-like" or "*Phasia*-like." This division is along the same lines as Brauer and von Bergenstamm's method of distinguishing groups and genera in Tachinidæ, and the influence of their work is probably responsible for its adoption here, as Townsend is an ardent disciple of these authors. I confess, however, that I cannot grasp the distinction, which may be perfectly clear to others, and I prefer to use another character which does not presuppose a knowledge of the structure of the heads of two other groups, which may not be available to the student. Comparative characters should not be used in major groupings in my opinion, and in discarding this one I supplant it with an absolute one. The character which I have selected for the differentiation of the Rhiniini and Cosminini is the absence or presence of a stigmatal bristle. This bristle is situated on the lower anterior angle of the mesopleura above the fore coxa and below the spiracle, and is always quite distinct from any hairs either pale or dark which may be present adjoining it. This stigmatal bristle is present in Cosminini and absent in Rhiniini. In the latter

\* Rec. Ind. Mus. xiii. 1917, p. 185.

group there are almost invariably many hairs present where the bristle ought to be, and these are usually curved forward.

In all Rhiniini known to me except the genus *Borbororhinia* the arista has hairs only on the upper side, while in Cosminini the arista is haired both above and below, though sometimes only pubescent.

It is not an easy matter to decide how many valid genera there are in the Rhiniini, but I consider that in Townsend's treatment of the group he used too many, the seven of those he uses which I consider to belong here being distinguished in some cases by characters of no more than specific value. I have carefully studied the species involved and append a generic synopsis which I hope may prove useful to other students of these flies.

Recently there has appeared a revision of the Indian species of Rhiniinæ by Senior-White. Though the classification proposed in this treatise is an advance on that proposed by Townsend, it has the same fault of dividing the two principal segregates on the shape of the epistome, which, as already stated, is not understandable to most students. Both Townsend and Senior-White place *Pollenia*, R.-D., in this subfamily, but I think this is an error. The genus has no radial setulæ and has more in common with the genus *Onesia*, R.-D., than it has with any genus in the group now under consideration, a fact borne out by the description by Townsend of the genus *Polleniopsis*, which is a synonym of *Onesia*, and the inclusion of *pilisquama*, S.-W., in *Pollenia*, this species being in my opinion an *Onesia*, close to if not identical with the genotype of *Polleniopsis*.

#### Key to Genera known to the Author.

- |   |                               |
|---|-------------------------------|
| 1. Arista with long hairs both above and below  | <i>Borbororhinia</i> , Towns. |
| Arista with hairs only on upper side . . . . .  | 2.                            |
| 2. Anterior posthumeral bristle absent; first posterior cell of wing closed at a considerable distance from margin of wing, the petiole rather long. . . . .            | <i>Chlororhinia</i> , Towns.  |
| Anterior posthumeral bristle present . . . . .  | 3.                            |
| 3. Mesopleura with at least three strong bristles on hind margin; first posterior cell of wing open . . . . .   | <i>Stomatorhinia</i> , Rond.  |
| Mesopleura with only two distinct bristles on hind margin, one on the extreme upper edge and the other a little below it . . . .  | 4.                            |
| 4. First posterior cell of wing usually closed at some distance from margin; hind tibia with a series of regular short setulose hairs on entire length of antero-dorsal |                               |

surface, amongst which there is rarely one or more longer and stronger bristles; second abdominal tergite of male with some very long bristly hairs on posterior margin on each side of median line except in *xanthogaster* .....

*Rhinia*, R.-D.

First posterior cell of wing open, rarely closed, if closed the petiole is inconspicuous; hind tibia with two or three outstanding bristles on antero-dorsal surface, the setulose hairs inconspicuous; second abdominal tergite in male without long apical hairs .....

*Idiella*, B. & B.

### Genus BORBORORHINIA, Townsend.

There is but one species of this genus known, *bivittata*, Walker, redescribed as *pubescens* by Townsend.

Senior-White records it from Buru Island, Borneo, Assam, South India, and Ceylon. I have a large series of specimens before me from Selangor and Pahang, Federated Malay States (*H. M. Pendlebury*).

### Genus CHLORORHINIA, Townsend.

The lack of the posthumeral bristle is sufficient, I think, to validate this genus, though the character is not mentioned by Townsend.

I have examined the genotype, *viridis*, Townsend, and have before me five specimens that belong to that species and one which appears to merit description as a new variety. The frontal orbits in the females are highly polished, with a small, grey, lateral, pruinulent mark in front of the middle, the bristles on inner margin are incurved, and there are no strong forwardly curved supraorbitals present. The thorax has no dorso-centrals nor acrostichals except the prescutellars. The discal cell of wing is rather suddenly widened at inner cross-vein, and from that point to apex is of almost uniform width; the inner cross-vein is distinctly beyond apex of the first vein.

#### *Chlororhinia viridis*, Townsend.

Originally described from Assam; type in Indian Museum. I have before me five females, two from the Federated Malay States and three from Australia.

#### *Chlororhinia viridis*, var. *fuscohirta*, nov.

*Female*.—Differs from typical *viridis* in being much darker in colour, blackish blue, the head glossy black with very

little trace of a blue tinge, with the same black setigerous dots on thorax and abdomen, the tibiæ darker, brownish, and the bases of wings and costa to apex of first vein distinctly brown. The variety has the fine occipital and pleural hairs fuscous, not yellow. A character of both is the presence of a bristle near middle of postero-ventral surface of fore tibia, at which point the tibia is thickest, and a series of short setulæ on ventral surface from middle to apex.

Length 7 mm.

*Type*, Lubok Tamang, Pahang, F.M.S., 3500 ft., 10. vi. 1923 (*H. M. Pendlebury*). Type deposited in British Museum.

#### GENUS STOMATORHINA, Rondani.

This genus has the arista long-haired above only, the eyes in male almost touching at middle above, parafacials with some hairs below apex of second antennal segment, orbits in female as in *Idiella*, facial carina sulcate above, palpi broad. Thorax as in *Idiella*, but the mesopleura with three or more long black bristles on hind margin. First posterior cell of wing open.

I have before me males of apparently three species, two from Africa, and one of these also from the Federated Malay States, and one from Japan. I have also two Australian species of the genus in hand, but do not deal with them here.

#### Key to Species (Males).

1. Fore coxæ tuberculate at middle on front side, the elevation furnished with about eight stout straight spines or bristles; all femora thickened, the mid-pair with several series of stout bristles on anterior side, most conspicuous at middle below; mesosternum, mid and hind coxæ, and basal two abdominal sternites with dense long crinkly golden hairs ..... *armatipes*, sp. n.
- Fore coxæ not tuberculate, and with only the usual bristles on anterior side; mid and hind femora not swollen, the former without stout anterior bristles; mesosternum, and mid and hind coxæ almost without golden hairs, those on basal sternite not soft and crinkly, but straight or curved. .... 2.
2. Fore coxæ yellow; mesopleura with quite large and conspicuous black dots at bases of the hairs, the latter golden yellow; a distinct dark mark covering apex of second vein of wing. .... *obsoleta*, Wied.
- Fore coxæ black; mesopleura without conspicuous black dots at bases of the hairs; no preapical costal mark on wing. .... 3.
3. Mesopleura with fuscous hairs. .... *lunata*, Fabr.
- Mesopleura with yellow hairs. .... *lunata*, Fabr., var.

*Stomatorhina lunata*, Fabricius.

Originally described from Madeira. I have seen several specimens from the type-locality, and one male from the Federated Malay States agrees very closely with the male in this lot. The females from Madeira and both sexes from Africa have the mesopleural hairs all golden yellow, but there is no structural distinction in the male hypopygia that I can observe.

*Localities.* Madeira, Federated Malay States, and Natal.

*Stomatorhina obsoleta*, Wiedemann.

Originally described from China. This species is readily distinguished from its allies by the characters listed in the key, the wing-marking being especially characteristic, none of the others having this, though one Australian species is so marked. The mesopleura has in the specimen of *obsoleta* before me only three marginal bristles, which are on the upper half. A more robust species than *lunata*.

*Locality.* Sapporo, Japan.

*Stomatorhina armatipes*, sp. n.

*Male.*—Colour similar to that of *lunata*, black, with a distinct greenish or bluish lustre, the frontal orbits grey pruinulent, with black setigerous dots, the thoracic dorsum with three dark vittæ and black setigerous dots, pleura grey pruinulent on upper half, but not densely so, abdomen with two or three tergites each with a transverse yellow or orange spot on each side, the same with white or grey pruinescence. Legs black, tibiae and tarsi but little paler. Wings yellowish.

Structurally as *lunata*, differing essentially as stated in the key.

Length 6–9 mm.

*Type* and four male paratypes, Willow Grange, Natal, 15–22. iii. and 3. v. 1914 (R. C. Wroughton).

It is possible that this species is already described, but only an examination of the types of the older authors will disclose this.

Of *Stomatorhina unicolor*, Macquart, I have only females available. These are very similar to the variety of *lunata* with yellow pleural hairs, but the abdomen is entirely blackish green, without yellow spots, and the wings are rather noticeably browned apically. This species I have seen from Java and the Federated Malay States.

## Genus RHINIA, Robineau-Desvoidy.

Townsend has erected two genera *Idelliopsis* and *Euidiella*, the former being in my opinion entitled to at most sub-generic rank, while I cannot admit even as much for the latter. In fact, unless one is prepared to erect a number of other genera for forms not represented in the small collection used by Townsend as the basis for his work on this sub-family, it is my opinion that many of that worker's genera must fall into synonymy, as they are frequently linked up by intermediate forms not known to him. In the genus *Rhinia*, in the wide sense, I find species which have the general form, habitus, and armature of the genotype, that do not have the first posterior cell of the wing closed, and in some others the cell is closed only in the margin of the wing, or the petiole is very short. I incline to the opinion that this closure of the cell is not a reliable character for the separation of genera, and have attempted to segregate them on other characters, as indicated in the key, which appear to me to be of greater importance. It is still a debatable point whether *Rhinia* and *Idiella* are really distinct genera; some light may be thrown upon the question by the discovery of the larval stages of the included species.

The accepted genotype is *testacea*, Robineau-Desvoidy.

There are several species in the genus, most of them being very closely similar in general appearance, and I have had to attempt to distinguish some of them by means of the hypopygia of the males.

*Key to Species known to the Author.*

1. First posterior cell of wing closed and with a short but distinct petiole ..... 2.  
     First posterior cell of wing open, or closed only in margin of wing, without a distinct petiole..... 6.
2. Entire pleura densely golden-yellow-dusted, least densely so on metapleura, the usual piliferous dark spots minute or lacking; large species, averaging about 10 mm. in length; abdomen usually entirely brick-red, sometimes dark at apex; femora black; second abdominal tergite of male without long apical bristly hairs; dorsum of thorax with short setulæ in both sexes; mid-femur in male with short stout preapical posterodorsal bristles forming a comb..... *xanthogaster*, Wied.
- Only the upper half of pleura densely golden-yellow-dusted, the sternopleura either glossy



## Malloch on *Exotic Muscaridæ*.

- black or lightly dusted and with conspicuous black setigerous dots, smaller species not over 7 mm. in length; mid-femoral comb if present consisting of weak short bristles ..... 3.
3. Sternopleura quite distinctly dusted, the piliferous dark dots on it, mesopleura, and posterior part of cheeks large and conspicuous; thoracic dorsum with three quite obvious dark vittæ; femora entirely, abdomen largely or entirely, black ..... 4.
- Sternopleura entirely glossy black on upper part, the piliferous dark dots extremely minute; thoracic dorsum very faintly trivittate; femora largely, abdomen entirely or almost entirely, yellowish testaceous..... 5.
4. Large species, averaging about 7 mm. in length; abdomen of male with first tergite except hind margin, a large transverse spot on each side of second tergite, and usually a smaller one on third, testaceous ..... Sp. 1.
- Smaller species, averaging less than 6 mm. in length; no conspicuous yellow spots on abdominal tergites..... Sp. 2.
5. Hypopygial claspers of male evenly rounded and tapered to apices (fig. 1) ..... *apicalis*, Wied.
- Hypopygial claspers of male angularly or subangularly bent, their apices subtruncate (fig. 2)..... *testacea*, R.-D.
6. Large species, 8-9 mm. in length; abdomen blackish green, subopaque on dorsum centrally; legs testaceous yellow, femora black. *Idiella melanostoma*, [Wied.]
- Smaller species, not over 7 mm. in length; abdomen in part testaceous ..... 7.
7. Hind femora conspicuously yellowish at bases *discolor*, Fabr.
- Hind femora entirely black or very inconspicuously yellowish at bases ..... *quadrinotata*, Big.
- N.B.—I have included *Idiella melanostoma* in the key lest any worker decide the species is referable here, though I personally prefer to place it in *Idiella*.

### *Rhinia xanthogaster*, Wiedemann.

Average length 8-9.5 mm. Entire pleura greyish-yellow-dusted. Abdomen rufous yellow, blackened at apex in male only. An Oriental species which I have seen from India and Java.

The species resembles some of those in *Idiella*, especially in colour, but I consider it more nearly related to *Rhinia*, the absence of the long apical hairs on second tergite in male probably entitling it to subgeneric rank, with the name *Idiellipsis*, Townsend, though only an intensive study of the whole group can decide this point definitely.

*Rhinia apicalis*, Wiedemann.

This species has sometimes been considered as a synonym of *testacea*, but the male hypopygium (fig. 1) is distinctly different in the African specimens which I have from that

Fig. 1.

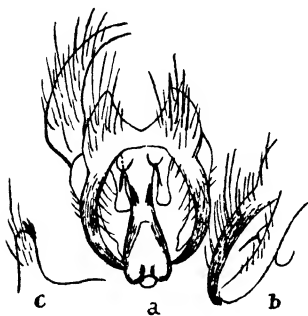


Fig. 2.

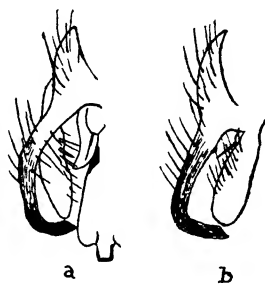


Fig. 3.

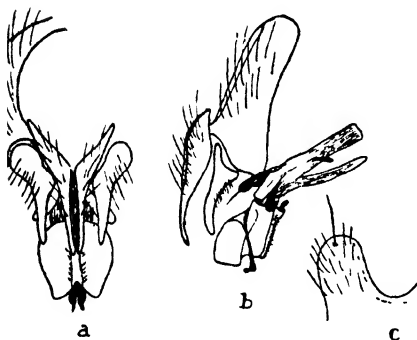


Fig. 4.



Fig. 1.—Hypopygium of *Rhinia apicalis*: a, rear view; b, side view of apex; c, ventral view of one process of the fifth sternite.

Fig. 2.—Hypopygium of *Rhinia testacea*: a, Ceylon form; b, Hawaiian and Philippine form.

Fig. 3.—Hypopygium of *Rhinia discolor*: a, rear view; b, side view; c, ventral view of one process of fifth sternite.

Fig. 4.—Hypopygia of African species of *Rhinia*: a, rear view of sp. 2; b, side view of apex of penis of sp. 2; c, side view of apex of penis of sp. 1.

of specimens originating from Ceylon, Hawaii, and the Philippines.

Two specimens, Gold Coast, Yapi, N. Territories, xi. 1915 (Dr. J. J. Simpson).

*Rhinia testacea*, Robineau-Desvoidy.

I have dissected the hypopygia of males from Ceylon, Hawaii, and the Philippine Islands, and consider that there are two closely allied species occurring in the Orient. Which of these is the true *testacea* I am unable to determine, and must leave the application of one or other of the available names to those who are in a position to examine the types of the older authors.

The Ceylon species has the hypopygium as in figure 2*a*, the one from Hawaii and the Philippines as in figure 2*b*.

*Rhinia discolor*, Fabricius.*Rhinia quadrinotata*, Bigot.

It appears extremely probable to me that the two names above may apply to the same species. The basal third of the hind femora in typical *discolor* is yellow in colour, contrasting sharply with the black apical part, while in typical *quadrinotata* the hind femora are black to the base. I have seen specimens, however, that are rather intermediate between these extremes, and as I can find no notable distinctions in the male hypopygia I consider that the most *quadrinotata* is entitled to is varietal rank.

Typical *discolor* I have before me from Java and the Federated Malay States; *quadrinotata* from the Philippines (fig. 3).

*Rhinia* spp. 1 and 2.

These are two African species which I cannot determine specifically.

Hypopygia as in figure 4.

Genus *IDIELLA*, Brauer & Bergenstamm.

I have before me a number of species from the Orient and Africa which are referable to this genus, and below present a key for the differentiation of the species from the Orient which belong to the group with colouring similar to that of *mandarina*, Wiedemann, *i.e.*, with the abdomen largely reddish yellow basally. It appears impossible to me to distinguish the species described by the older authors, and it is possible that an intensive study of their types, if still in existence, will dispose of several of the names as synonyms. I have been able to verify the synonymy of *mandarina*, Wiedemann, and *nigricauda*, Bigot, through the agency of

Mr. J. E. Collin, who has reported to me on the characters of the type of the latter in the Bigot collection. The description of *mandarina*, though less comprehensive than one might desire, is sufficiently clear to indicate that it is the species I here assign to it, though there is a closely allied species which occurs also in China.

It will be at once evident to anyone having access to Senior-White's paper on the Indian *Rhiniinæ* that our interpretations of this genus are widely different. This difference is due to the fact that in my system the number of mesopleural bristles is accepted as the separating character, while he accepts the comparative size of the male hypopygia. Practically all recent workers are rejecting sexual characters as generic criteria.

In this genus the propleural bristle is present, usually duplicated, stigmal bristle absent, first posterior cell of wing open, or closed only in the margin of wing; the mesopleura has but two hind marginal bristles, the upper one on extreme upper angle, and the eyes of the males are usually a little more widely separated than is the case in *Rhinia*. In general, the species resemble those of the genus *Rhinia*, but the latter are more robust in build, and are otherwise distinguished as indicated in the foregoing generic key.

Genotype, *Idiella mandarina*, Wiedemann.

### *Key to Species (Males).*

1. Fore coxæ with the strong black bristles extending from apex to well basad of middle on front side ..... 2.  
     Fore coxæ with the strong black bristles confined to apex or apical third ..... 4.
2. Mid-tibiæ with dense soft black hairs at apices on ventral surfaces, which are mostly distinctly longer than diameter of tibiæ and give them a tufted appearance; hind femur with the ventral bristles, and especially those on antero-ventral surface, strong and much shorter than diameter of femur; abdomen with a black central vitta above on the yellow basal portion, but without blackish lateral marginal vittæ; fifth abdominal sternite glossy black and very prominent ..... *mandarina*, Wied.
- Mid-tibiæ with at most rather sparse fine hairs on ventral surfaces, the hairs when present not noticeably longer than the tibial diameter .. 3.
3. Fifth abdominal sternite a little convex in normal position, the glossy basal portion broadly rounded at apex, the lateral posterior processes with a number of hairs near bases, which are as long and strong as those at apices ..... *orientalis*, sp. n.

Fifth sternite conspicuously elevated and a little compressed at apex of basal glossy portion, almost keel-like in normal position, the demarcation almost V-shaped, the lateral posterior processes with one or two hairs near bases, which are much finer and shorter than those at apices . . . . .

*sternalis*, sp. n.

4. Hind tibiæ usually entirely orange-yellow, the hairs on middle of postero-ventral surface finer and noticeably longer than usual, as are also those on ventral surfaces of mid-tibiæ . . . . .

*pilitibia*, sp. n.

Hind tibiæ black except at bases, neither the hind nor mid tibia with exceptional hairing . . . . .

*nigritibia*, sp. n.

N.B.—I omit *simplex*, Walker, and *melanostoma*, Wiedemann, as I do not possess males of either. Both belong here, I believe, and the females have the abdomen all dark.

In the description of *lateralis*, van der Wulp, the palpi are stated to be yellow, which character should distinguish the species from any before us, all of which have the palpi black, or with only their bases slightly yellowish. I have no specimens that answer to the description of *euidielloides*, Senior-White, amongst the smaller species before me, and do not include it in my key because it is impossible to place it definitely from the original description; I believe it is distinct from any of my species. I cannot make any of the species described by Macquart agree with those before me. His *tripartita* has evidently the apical part of the wing with a rather distinct brown spot, and is about 8 mm. in length; *marginata* is smaller, 5–6 mm. in length, and agrees fairly well with one of the Javanese species before me, coming from the same island, but the two basal segments of the fore and hind tarsi are whitish, and the basal segment of the mid-pair is testaceous, which is not the case in either of the smaller species I list here; *limbipennis* apparently has no yellowish colour on the basal part of the abdomen. It is unnecessary to emphasise the fact that an examination of the type-specimens is essential to decide definitely the status of the species, and until this is done the names used below will stand.

*Idiella orientalis*, sp. n.

*Male*.—Head black, sides of occiput above, entire occiput below and to middle of cheeks, orbits except round bases of bristles, and a patch on middle of parafacial, densely yellowish grey pruinose; antennæ brownish black, base of arista yellow; palpi fuscous. Thorax with dorsum, including scutellum, greenish or bluish, with a black spot at base of each bristle and hair; pleura deeply coated with yellowish

pruinescence, which obscures the ground-colour, a small blackish dot at base of most of the larger hairs; postnotum metallic greenish or bluish black, with slight white pruinescence. Abdomen reddish; hypopygium, all of fourth tergite, and the greater part of third, black, with a strong metallic blue or green tinge. Legs tawny yellow, fore coxæ densely yellowish pruinulent, mid and hind coxæ and all femora black, the latter with a greenish tinge, apical four segments of fore and apical two segments of mid and hind tarsi black. Wings yellowish, with a brown cloud on costa at apex. Calyptæ and knobs of halteres yellow. Fine hairs on lower part of head, pleura, coxæ, and venter golden yellow.

Fore coxæ each with a strong bristle basad of middle, and a series from it to apices; posterior bristle on fore tibia strong; apical four segments of fore tarsi widened; mid-femur with the postero-ventral bristles quite short and irregular; hind femoral bristles short, stout, and irregular on antero-ventral surface, longer and finer on basal half of postero-ventral: neither mid nor hind tibiæ with outstanding ventral hairs. Fifth sternite of abdomen not prominent when abdomen is viewed from the side.

*Female*.—Similar to the male, except that the frons is about one-third of the head-width. Apex of abdomen with short but distinct marginal bristles. The two apical abdominal tergites are greenish black, and the fore tarsus is black from just before apex of basal segment to apex of tarsus.

Length 7–9 mm.

*Type*, male, 9 miles S.W. of Tatsienlu, China, 25–7. vii. 1921, 8500–13,000 ft. (*D. C. Graham*). Allotype, Szechuen, China. Paratypes, same locality and collector as allotype, and Tsin Lung Shan, 65 miles N.E. of Peking, China (*Ada C. Sowerby*).

*Idiella mandarina*, Wiedemann.

*Male and female*.—Structurally similar to the foregoing, but distinguishable by the characters listed in the key. The antennæ are yellowish basally, while in the preceding species they are entirely black. This last character holds in both sexes of the two species. The tuft-like hairs on apices of the mid-tibiæ in the male and the keeled fifth abdominal sternite in same sex readily distinguishes it from its allies, though *euidielloides*, S.-W., apparently has the last character too.

Length 9 mm.

I have seen this species from China, India, and Key Islands.

The female from India has only the fourth tergite greenish black.

I have what may be a distinct but closely allied species from Sumatra, but my specimen is in poor condition, so I leave it aside meantime.

*Idiella sternalis*, sp. n.

*Male and female*.—This species is very similar to *mandarina* in the structure of the abdomen of male, the fifth sternite being quite as prominent from the side and armed in the same manner as in that species. There is, however, no trace of a ventral tuft-like aggregation of hairs on mid-tibia, the mid-femur has a series of fine bristles beginning at base on postero-ventral surface which gradually decrease in length apically, the hind femur has sparse fine bristles on entire length of antero-ventral surface and long setulose hairs on basal two-thirds of postero-ventral surface, some of which are longer than the femoral diameter, and the hind tibial bristles are longer and stronger. The antennæ are entirely black.

Length 8 mm.

*Type and allotype*, Baguio, Benguet, Philippine Islands (*Baker*). Paratypes, two males, Manila, Philippine Islands (*R. C. McGregor*), one male without definite locality, but from the Philippines also (*D. B. Mackie*).

*Idiella pilitibia*, sp. n.

*Male and female*.—A smaller and more slender species than any of the three preceding. There are usually three fuscous lines on abdomen projecting over the yellow basal part in this and the next species, one in centre and one on each side. The wings in both are rather evenly browned along costa, the apical broadened part, so distinct in *mandarina*, being indistinguishable.

The femora are rather robust, the mid-pair have some long hair-like bristles on basal half of postero-ventral surface, and the hind pair besides the long fine antero-ventral and postero-ventral bristles have the ventral hairs longer and more erect than usual. Other characters as noted in the key. Hypopygium and fifth sternite as in *orientalis*, not prominent from the side.

*Female*.—Similar to male, frons about one-fourth of head-width.

Length 6–7 mm.

*Type*, male, allotype, Tjibobas, Java (*Karny*). Paratypes, 3 Pahang, Kuala Tahan, Federated Malay States, and 3 Selangor, Kuala Lumpur, Federated Malay States (*H. M. Pendlebury*), 1 Singapore, v. 1924.

*Idiella nigritibia*, sp. n.

*Male and female*.—Similar to the preceding species, differing only as indicated in the key. The frons of the female is about one-fourth of the head-width.

Length 5–6.5 mm.

*Type*, male, Pahang, Federated Malay States, 12. i. 1924 (*M. A. Henderson*). Allotype, Pahang, Camerons Highlands, 21. vi. 1923. Paratypes: 3 Perak, 4 Pahang, 2 Selangor, Federated Malay States.

*Idiella melanostoma*, Wiedemann.

A female evidently belonging to this species has the greater portion of the sterno-pleura above with very slight dusting, in marked contrast to the densely dusted meso-pleura. The abdomen is not red at base, but uniformly black with a greenish tinge on sides, the black dots at bases of hairs evident only on sides and below.

The fore legs in my specimen are missing, but the mid and hind pairs have the femora glossy black, and the tibiæ and tarsi rufous yellow, the latter darkened at apices. The apical dark spot on wing is rather prominent.

Structurally similar to *orientalis*, but the general habitus is stouter, and the central carina between bases of antennæ is not nearly so high and is much broader and flattened.

Length 9 mm.

*Locality*. Buitenzorg, Java. Originally described from Java.

*Idiella simplex*, Walker.

Very similar to the last species, but much smaller, the sternopleura with distinct though not dense whitish dusting above, and, like the mesopleura, with quite large black dots at bases of the hairs. As in *melanostoma* the interantennal carina is low, but it is more definitely sulcate and the sulcus is longer than in that species. All specimens have the first



## Malloch on *Exotic Muscaridæ*.

posterior cell of wing closed at or a little before the margin of wing, while in *melanostoma* it is distinctly open.

Length 6-7 mm.

A large series of specimens from Sumatra (*Karny*), and two from the Federated Malay States (*H. M. Pendlebury*), all females.

### *Idiella albitarsis*, Macquart.

I have seen only one female of this species. It has the legs rufous yellow, fore trochanters, extreme tips of all femora, tip of basal segment of fore tarsi, and apical three segments of other tarsi fuscous, bases of tarsi whitish. Antennæ and palpi black, cheek with a vertical stripe of yellow pollen behind. Thorax as in *mandarina*, but only the upper half of pleura yellow-dusted. Abdomen rufous, slightly darkened on disc. Wings brownish along costa.

The fore coxæ have bristles from middle to apices, the apical tergite has some weak hind marginal bristles and the first posterior cell of wing is open.

Length 6.5 mm.

Africa.

### *Idiella major*, sp. n.

*Female*.—Similar in colour to *orientalis*, but the abdomen is slightly darkened on disc only, and the wings are slightly and uniformly browned. Pleura entirely yellow-dusted. Lower calyptra browned on inner half.

Facial carina high, longer than usual, and very sharp. Fore coxæ bristled from middle to apices. First posterior cell open. Fourth visible abdominal tergite slightly, broadly, angularly emarginate on posterior margin and furnished on entire margin with moderately long, closely placed bristles.

Length 12 mm.

*Type*, Sierra Leone, 21. v. 16 (*Dr. J. Y. Wood*).

Labelled "biting at dark." The specimen does not impress one as being able to bite, but may be attracted by perspiration. I have been unable to match this species with any description known to me. Its large size and the peculiar form and armature of the fourth tergite ought to distinguish it at once in the female sex, but, unfortunately, those are characters that the older authors did not mention in their descriptions.

## Tribe COSMININI.

This tribe contains a number of genera which are rather difficult to separate on the basis of reliable characters. I

have found those embodied in the subjoined key the most acceptable to my mind, but possibly other workers may be of the opinion that these also are unsatisfactory; however, they appear to associate the species herein included in a better manner than does any key known to me, and I am presenting it herewith in the hope that it may prove useful to others studying the family. We particularly lack a knowledge of the early stages of these insects.

*Key to Genera known to the Author.*

1. Eyes in both sexes separated by about one-fourth of the head-width; fore tibia without any median bristles, hind tibia with a rather long postero-dorsal bristle close to middle; thoracic dorsum with two pairs of prescutellar, and one short pair of presutural, dorso-centrals; inner cross-vein of wing beyond apex of first vein, that vein and auxiliary entering the costa at same angle; arista short-haired . . . . . *Sumatria*, gen. nov.
- Eyes of male separated by very much less than one-fourth of the head-width, those of female separated by about one-fourth; fore tibia usually with at least one median bristle; hind tibia with at least two postero-dorsal bristles . . . . . 2.
2. Arista bare or short-haired, the longest hairs not as long as width of third antennal segment, auxiliary and first veins connecting with costa at same angle; inner cross-vein before or below apex of first vein . . . . . 3.
- Arista plumose, the longest hairs much longer than width of third antennal segment . . . . . 6.
3. Only the prescutellar pair of dorso-central bristles well developed; scutellum prominently convex; frontal orbits and parafacials glossy, the latter practically bare; arista almost bare . . . . . *Stegosoma*, Lw.
- Dorso-centrals, and usually also the acrostichals, well developed on the entire length of thorax; scutellum normal; arista usually distinctly pubescent . . . . . 4.
4. Some strong black setulæ of suprasquamal ridge close to base of scutellum . . . . . *Eurhyncomyia*, gen. nov.
- No setulæ on suprasquamal ridge at any point . . . . . 5.
5. Propleura bare in centre . . . . . *Rhyncomyia*, R.-D.
- Propleura haired in centre . . . . . *Metallea*, Wulp.
6. Scutellum with two strong bristles a little before middle of disc, the disc devoid of setulæ except at base anterior to the discal bristles . . . . . *Chloroidia*, Towns.

- Scutellum with or without subapical discal bristles, and always setulose on entire surface above . . . . . 7.
7. Presutural acrostichal and dorso-central bristles inconspicuous except sometimes the posterior pair of dorso-centrals, the acrostichals usually indistinguishable from the adjoining hairs, the anterior pairs of postsutural dorso-centrals also poorly developed . . . . . *Cosmina*, R.-D.
- Presutural and postsutural acrostichal and dorso-central bristles strong and conspicuous . . . . . 8.
8. Frontal orbits wider than usual, in male occupying entire frons, in female four or five times as wide at anterior extremities as anterior margin of interfrontalia . . . . . *Thoracites*, B. & B.
- Frontal orbits normal, in male always leaving a conspicuous triangular area of interfrontalia exposed anteriorly, in female not or but little wider anteriorly than the interfrontalia . . . . . 9.
9. One or two short black setulæ on auxiliary vein close to humeral cross-vein on upper side of wing . . . . . *Anna*, gen. nov.
- No setulæ as above . . . . . 10.
10. First wing-vein setulose below at base . . . . . *Strongyloneura*, Big., part.
- First wing-vein bare below at base . . . . . *Strongyloneura*, Big., part.
- N.B.—For remarks on possible subgenera see under the different genera in the text.

### Genus SUMATRIA, nov.

*Generic Characters*.—A peculiar genus with a very obvious Rhiniine appearance, which is enhanced by the arista being distinctly though shortly haired above and nearly bare below, and the stigmal bristle weak though distinct. There is no other genus known to me in either tribe which has the eyes separated by about one-fourth of the head-width in both sexes, and the fore and hind tibiæ as in this genus. The frontal orbits are narrow, with the supraorbital bristles in the same line as the infraorbital series, the face is not carinate, parafacials narrow and bare, vibrissæ short and strong, the vibrissal angle slightly produced, bend of fourth vein rounded, the apex of vein running parallel to apex of third for a short distance.

Genotype, the following species.

#### *Sumatria latifrons*, sp. n.

*Male and female*.—Shining bronzy black. Frontal orbits, a spot on parafacial below bases of antennæ, and back of

head and posterior part of cheeks white-dusted; antennæ brownish; palpi fuscous. Thorax and abdomen without noticeable dusting. Legs brown, fore coxæ, tibiæ, and bases of tarsi yellowish. Wings brownish, conspicuously so at apices. Calyptræ and halteres brown.

Orbits almost linear, bare except for the bristles along their inner margins, the upper bristle curved backward, second slightly forward, the others inward; hairs on upper side of arista not as long as width of third antennal segment basally, and ceasing near middle; palpi slightly widened. Dorso-central bristles 1+2, only one pair of prescutellar acrostichals present; dorsal and pleural hairs black. Abdomen elongate-ovate; hypopygium of male of moderate size, the forceps slender and curved, widely separated at bases; processes of fifth sternite widely divergent. Mid-femur without a preapical comb in either sex; hind femur in male with a few fine bristles on basal half of postero-ventral surface and one strong preapical antero-ventral bristle, the female without the postero-ventral bristles or with a few setulæ; hind tibia with one antero-ventral, one antero-dorsal, and one postero-dorsal bristle, the preapical dorsal bristle quite long and fine.

Length 4-5 mm.

*Type*, male, allotype, and one male paratype, Sumatra, 1921 (*Karny* and *Siebers*). A female from Pahang, Federated Malay States, has the thorax slightly grey-dusted and rather indistinctly vittate, the base of abdomen yellowish, and the legs paler than in the Sumatra specimens. I consider it tentatively as the same species.

#### Genus *STEGOSOMA*, Loew.

I have seen only one of the two species of this genus.

#### *Stegosoma vinculatum*, Loew.

This very pretty fulvous-yellow species is distinguished from *wellmani*, Lichtw., by the immaculate yellow abdomen, the other having narrow black posterior fasciæ on the segments.

I have seen *vinculatum* from Natal.

#### Genus *EURHYNCOMYIA*, nov.

*Generic Characters*.—Similar to *Rhyncomyia*, differing in being more robust, and as indicated in the key to genera previously given in this paper. I have seen only females,

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and in this sex each frontal orbit is a little wider than the interfrontalia, and has an inner incurved series of bristles, and usually more than one outer series of obliquely forwardly directed bristles, with the usual grey pruinescence and black dots at their bases. Arista with the longest hairs not as long as width of third antennal segment; palpi rather broad; genitalia spinose; bend of fourth vein subangular.

Genotype, *Rhyncomyia obtusa*, Bigot.

*Eurhyncomyia obtusa* (Bigot).

*Female*.—Head fulvous, shining, upper part of frontal orbits, and occiput except lower part, black, grey-dusted, the orbits with black dots; proboscis black. Thorax metallic green. Abdomen fulvous, with a blackish-green dorso-central vitta which connects with a similarly coloured fascia at apex of each tergite. Femora black, tibiæ and bases of tarsi fulvous. Wings greyish hyaline. Parafacials and cheeks may each have a dark mark or none.

Length 7·5–9 mm.

Many specimens from Natal.

Genus RHYNCOMYIA, Robinson-Desvoidy.

After carefully studying the various papers which refer to or deal with species assigned to this genus I could not obtain a definite idea of the generic characters, and to provide a basis for accurate generic determination I borrowed a male specimen of the genotype, *ruficeps*, Fabricius, from Dr. Bezzi. My uncertainty as to the generic limits was due to the fact that I had before me several species with short-haired or pubescent aristæ that might upon the basis of other characters conceivably be considered as entitled to subgeneric segregation, and to which of these segregates the genotype of *Rhyncomyia* belonged I could not decide. An examination of *ruficeps* shows that it belongs to that group in which there are no fine hairs on the middle of the propleura, and no setulæ on the posterior extremity of the suprasquamal ridge.

I present below a characterization of the genotype. There are some other species belonging to this genus, one or two of which occur in Africa, but I have not sufficient material at this time to present a key to the species.

*Rhyncomyia ruficeps* (Fabricius).

*Male*.—Head orange-yellow, parafacials almost golden, third antennal segment brownish, arista black. Thorax

green, slightly dusted, and subvittate dorsally. Abdomen yellow, green on apical two or three tergites and hypopygium. Legs blackish, apices of femora, the tibiæ, and bases of tarsi yellowish. Wings greyish hyaline. Calyptræ and halteres yellow.

Frons about as wide at narrowest part as third antennal segment, widened in front; parafacial about three times as wide as third antennal segment, with fine black hairs; facial carina hardly developed; arista with the longest hairs about as long as its basal width; vibrissal angle distinctly produced; proboscis slender, rather long; palpi long. Prosternum haired; propleura bare; dorso-centrals 2, 3+4, acrostichals 1, 2+3, 4, intra-alars 3, anterior one weak. Abdomen elongate-ovate, the pairs of hypopygial forceps subequal in length. Mid-tibia with a ventral median bristle. Only the base of third wing-vein haired; bend of fourth vein as in *Musca domestica*, L.

Length 9.5 mm.

Europe.

#### Genus *METALLEA*, van der Wulp.

I place in this genus all the species with short-haired or pubescent arista that have the centre of the propleura haired. This group may be susceptible to subdivision, but not along the lines indicated by Townsend in distinguishing *Metallopsis*. I am not certain how many distinct species there are in the genus, but hope at some future time to obtain enough additional material to enable me to make a revision of the genus.

Genotype, *Metallea notata*, van der Wulp. Oriental.

#### Genus *CHLOROIDIA*, Townsend.

*Generic Characters*.—Frons of female about one-fifth of the head-width at vertex, wider anteriorly, orbits widened anteriorly, above antennæ wider than the narrow interfrontalia, each with two strong supra-orbitals, the upper backwardly, the lower forwardly, directed, anterior to these several weaker incurved inner marginal bristles; parafacial bare; facial carina absent; arista plumose; palpi narrow. Thorax with 2 or 3+4 strong dorso-centrals and acrostichals, about three intra-alars, four bristles on the presutural area, and practically no fine surface-hairs or setulæ; centre of propleura bare. Fourth tergite with discal bristles. Inner cross-vein beyond apex of first vein.

I have seen only the female of this monobasic genus.

*Chloroidia prolata* (Walker).

This beautiful species has the head densely yellow-dusted on the postocular, frontal, and facial orbits, and on the cheeks except in centre; the third antennal segment, palpi, and lower part of face yellow. Thorax metallic green, overlaid with dust so that it appears dull, but shining where abraded. Abdomen green, with a broad dorso-central stripe and fasciæ at apices of tergites black, the black parts apically tinged with coppery. Legs greenish black, tibiæ and bases of tarsi fulvous. Wings greyish.

Length 5-6 mm.

Originally described from India. I have seen it from Perak, Federated Malay States (*H. M. Pendlebury*).

Genus *COSMINA*, Robineau-Desvoidy.

I have made a very careful comparison of the genotype of *Synamphoneura*, Bigot, with the species of *Cosmina* available to me and have failed to find any outstanding structural characters by means of which one may be distinguished from the other. It is true that the only species of the former is much more slender than are those of *Cosmina*, and that the male has the hypopygium much larger, but taking the species as a whole, structure by structure, they present no differentiating characters of generic import. Even if we accept the presence or absence of propleural hairs as a criterion for subgeneric division the case is not much bettered, as both genotypes have these, and we are only confronted with the necessity for the erection of a genus or subgenus for the reception of two other species dealt with in the present paper. These hairs are rather variable in *bicolor* (= *cuprina*), as, owing to their being very fine and weak, they may be almost or quite absent in some specimens.

I present below a key to the species available to me at this time, some of them being described as new because it has been impossible to determine them as already described.

*Key to Species.*

- |  |                           |
|--|---------------------------|
| 1. Propleura with some fine hairs in centre. . . . .   | 2.                        |
| Propleura bare in centre . . . . .   | 5.                        |
| 2. First posterior cell of wing closed and with a short apical petiole; palpi black, long, and strap-like. . . . . | <i>petiolata</i> , sp. n. |
| First posterior cell of wing normally open; palpi short and more or less leaf-like. . . . .                        | 3.                        |

3. Palpi clear yellow at bases, black on apical half or more, the tips whitish-dusted; male hypopygium large ..... *bicolor*, Walk.  
 Palpi entirely black; male hypopygium small 4.  
 4. Eyes of male with the facets on upper half quite conspicuously larger than those on lower half ..... *punctulata*, Wied.  
 Eyes of male with the facets on upper half very slightly larger than those on lower half ..... [nov.  
*punctulata*, var. *microps*,  
*bicolor*, Walk.  
 5. Palpi clear yellow at bases, black at apices. 6.  
 Palpi entirely black .....  
 6. Thorax with traces of four black vittæ anteriorly, without one in centre; greenish species ..... *undulata*, sp. n.  
 Thorax with traces of five black vittæ anteriorly, the central one most distinct; blue-black species ..... *nigrocærulea*, sp. n.

*Cosmina punctulata*, Wiedemann.

*Male and female*.—Parafacials and orbits grey pruinulent, a shining black mark opposite bases of antennæ, one on middle of parafacial, and a large one on middle of cheek; antennæ brownish; palpi black. General body colour black, with a coppery or brassy tinge, the thorax with slight whitish dusting and four black vittæ, the submedian pair most distinct and situated over the dorso-centrals, a faint central line is usually also visible, and the entire dorsum including that of scutellum has a blackish dot at base of each hair and bristle. Abdomen more densely white pruinulent than thorax, with a very faint dorso-central dark vitta, and black dots as on thorax. Legs black, with a coppery tinge, the tibiæ and tarsi brownish yellow, the former sometimes darker. Wings greyish, fuscous along costa, the dark cloud becoming more expansive near apex of wing. Calyptræ yellowish white, darker apically. Halteres dirty yellow.

*Male*.—Frons reduced to a mere line on more than half its length; third antennal segment fully twice as long as second; palpi leaf-like. Thorax with one pair of acrostichals and one pair of dorso-centrals before suture, all very fine; two pairs of dorso-centrals and one pair of acrostichals before scutellum, anterior dorso-centrals short. The two pairs of hypopygial forceps equal. Fore tibia with one posterior and three or four short antero-dorsal setulæ; mid-tibia with a ventral bristle. First posterior cell open.

*Female*.—Frons at vertex about one-fourth of the head-width, about one-third at anterior margin. Genitalia with a crown of spines.

Length 7–9 mm.

*Localities*. Gold Coast, Uganda, Nyasaland, and Angola.



*Cosmina punctulata*, var. *microps*, nov.

This form is identical with the typical form in colour etc., differing only in having the eye-facets more uniform in size and the frons with the linear part much shorter. Lack of material prevents me from making a dissection of the hypopygium to determine whether it is specifically distinct.

Length 8 mm.

*Type*, Gold Coast, N. Territories, Yapi, ix. 1915 (*Dr. J. J. Simpson*).

*Cosmina undulata*, sp. n.

*Male and female*.—Differs in colour from *punctulata* in having the thorax and abdomen metallic blue or blue-green, the tibiæ darker, calyptreæ more brownish, the third antennal segment shorter, hind tibia with about three bristles of a rather uniform length, and as stated in contradistinction in key.

Length 7–9 mm.

*Type*, male, allotype, three male, and one female paratypes, Ibadan, S. Nigeria.

*Cosmina petiolata*, sp. n.

*Female*.—Similar in colour to *punctulata*, the dorsum of thorax with traces of a dark central vitta.

The arista is more copiously haired above than in *punctulata*, the hairs basally appearing to form two series, the palpi are about as long as proboscis beyond the geniculation and are almost equally wide on their entire length. Long hairs behind the mesopleural bristles yellow. Fourth visible tergite with a few short erect bristles on each side of dorsum. Otherwise as *punctulata*, except in having the first posterior cell of wing shortly petiolate.

Length 10·5 mm.

*Type*, Gold Coast, N. Territories, Yapi, xi. 1926 (*Dr. J. J. Simpson*).

*Cosmina bicolor* (Walker).

This species is the same as *Synamphoneura cuprina*, Bigot. There is no material difference in the armature of the fourth tergite in either sex from that of any species of *Cosmina*, and the larger hypopygium of the male in *bicolor* is not sufficient to justify even a subgeneric separation.

I have before me many specimens from the Federated Malay States, as well as one from Singapore and one from Java.

*Cosmina nigrocærulea*, sp. n.

*Male and female*.—Head black, frontal orbits grey-dusted, with the usual black setigerous dots; interfrontalia in female brown; face and cheeks black, in part brownish, a grey-dusted spot at middle of parafacial, only the middle of cheek glossy black, the front brownish with grey dust, the back part grey-dusted; antennæ brown, paler at bases; palpi black. Thorax metallic blue or greenish with greyish dust, the dorsum with many setigerous black spots and traces of five black vittæ; pleura unspotted. Abdomen coloured as thorax, but with hardly a trace of dusting. Legs almost entirely black, the femora with greenish tinge, mid and hind tarsi brownish basally. Wings infuscated, more intensely so on costal portion. Calyptræ and halteres fuscous.

Structurally similar to *punctulata*. Facial carina broad and low, sulcate above; palpi broad and short. It is noteworthy that while the dorso-centrals and acrostichals, except the prescutellar pair, are very weak in the other species, they are usually distinguishable, whereas in the present species they are not at all evident. First posterior cell open.

Length 9–11 mm.

*Type*, female, allotype, and three female paratypes, Pahang, Kuala Tahan, Federated Malay States (*H. M. Pendlebury*).

This is evidently a quite distinct species from *Cosmina ænea*, Walker, to judge from Senior-White's description of *indica*, which he has listed as a synonym of *ænea*.

## Genus THORACITES, Brauer &amp; Bergenstamm.

This monobasic genus has the vibrissæ much above the mouth-margin and separated by a distance not greater than the distance of either from the eye-margin. Although the arista is plumose, the genus has much the appearance of a *Metallea*.

*Thoracites abdominalis*, Fabricius.

Head yellow, upper occiput black. Thorax metallic green with white dusting. Abdomen fulvous yellow with white dusting, a faint dark dorso-central line, black margin to fourth tergite, and a black spot on each side of all except the basal tergite and another on extreme lateral margins; sternites mostly black apically. Legs black, tibiæ and bases of tarsi paler. Wings fuscous on costa, most noticeably so beyond apex of first vein.

Length 7–8 mm.

I have seen this species from Ceylon and India.

## Genus ANNA, nov.

*Generic Characters*.—Robust, *Calliphora*-like species with similar characters to *Strongyloneura*, Bigot. Female with two long strong forwardly directed supraorbital bristles on each side of frons, orbitals descending to about opposite apex of second antennal segment; facial carina quite prominent and rounded basally, sulcate above; parafacial wider than the rather narrow third antennal segment, setulose; vibrissæ well above mouth-margin, not noticeably approximated; arista plumose; palpi only slightly widened apically. Dorso-centrals and acrostichals strong; propleura bare in centre; postalar declivity with microscopic hairs in centre. Fourth abdominal tergite with numerous long erect discal bristles. Legs as in *Strongyloneura*. One or two short bristles at junction of humeral cross-vein and auxiliary vein on upper side of wing; bend of fourth vein as in *Musca domestica*, Linné.

Genotype, the following species.

*Anna calliphoroides*, sp. n.

*Female*.—Black with a bluish tinge, much the same as *Calliphora erythrocephala*, Linné, but the abdomen is less evidently checkered, the cheeks are black and with black hairs, the palpi are black, and the calyptræ brown. Thorax 5-vittate.

Frons at vertex about one-fourth of the head-width, at anterior margin about one-third; orbits of moderate width, bristles strong, outer hairs distinct, interfrontalia with some fine hairs. Thorax with 2+4 dorso-centrals and 1, 2+3 acrostichals; intra-alars 3, all strong; prealar long. Abdomen ovate. Legs normal. Calyptræ rounded, not wide.

Length 10–11 mm.

*Type*, east side of edge of Forest of the Aberdare Mts., 7300 ft., 24. ii. 1911; paratype, West of Mt. Kenia, 6500 to 7250 ft., 19–20. ii. 1911 (*T. J. Anderson*).

## Genus STRONGYLONEURA, Bigot.

I have in preparation a key to all the species of this genus known to me from Africa and the Orient, which I hope to be able to publish in a future paper of this series. Meanwhile, I present descriptions of one new and notes on some already described species.

I have not seen *prasina*, Bigot, the genotype of *Strongyloneura*, and without a careful examination of this it is

impossible to decide which of the segregates of the genus it belongs to. I have before me many specimens of *tristis*, Bigot, which may be accepted as the genotype of *Apollenia*, Bezzi, though not cited as such. As mentioned in the preceding part of this series Bezzi cited *nudiuscula*, Bigot, as the genotype, but this citation was in error, as shown by the specimens he had before him, which are now in the United States National Museum. These belong to *tristis*, and this must be accepted as the genotype. *Thelychaeta*, Brauer & Bergenstamm, is evidently the same as *Strongyloneura*, and *Synamphoneuropsis*, Townsend, is apparently not deserving of generic distinction.

The genus, as I accept it, contains species with a plumose arista and strong presutural and postsutural dorso-central and acrostichal bristles. Although there are several segregates in the genus, the best available characters blend more or less in some of the groups, and it is difficult to accept even subgeneric status for any of them. When I publish my key to the genus these points will be fully dealt with.

*Strongyloneura tristis*, Bigot.

A black species with more or less coppery or violaceous tinge on thorax. The facial carina is distinct, rather broadly sulcate; the cheeks are black-haired and about as high as length of third antennal segment; the palpi are spatulate and brownish. Fine thoracic hairs all black. Abdomen ovate, fourth tergite in female with strong median bristles. Mid-tibia of female with a strong median ventral bristle, hind tibia in same sex with one or two antero-ventral bristles.

Length 10–11 mm.

I have seen many specimens of this species from Durban, Natal.

*Strongyloneura oculosa*, Villeneuve.

*Male*.—Head black, grey-dusted; face, cheeks, antennæ, and palpi reddish testaceous. Thorax black, shining, slightly æneous or cupreous, brownish on posterior region and on pleural sutures with rather dense grey dusting, the dorsum with faint narrow vittæ. Abdomen concolorous with thorax, the dorsum irregularly checkered. Legs reddish brown, apices of femora faintly darker, apices of tarsi fuscous. Wings yellowish hyaline. Calyptræ and halteres yellow. Fine hairs on occiput, stigmal region, lower half of pteropleura, upper part of sternopleura, metapleura, and ventral surface of scutellum yellow, the others black.

Head broader than thorax, the eyes much larger than their facets much enlarged on upper anterior half or linear above, orbital hairs absent; facial carina in middle above; lunule sparsely haired; palpi spatulate. Propleura bare in centre; hypopleura with hairs on the upper anterior margin; spiracle with fine decumbent hairs anteriorly; suprasquamal declivity with a few hairs above in middle; thorax with 2+4, 5 dorso-centrals and acrostichals; intra-alars 3. Abdomen short and broad; fourth tergite without any strong discal bristles. Fourth vein subangularly bent.

Length 11 mm.

*Locality.* Sawmills, S. Rhodesia, x. 1922 (*Dr. G. Arnold*).

*Strongyloneura lancifer*, sp. n.

*Male*.—A black species somewhat similar to *tristis*, the coppery tinge on thorax and abdomen quite pronounced. Third antennal segment brownish; palpi fuscous. Thorax not noticeably vittate. Abdomen with faint dark dorso-central vitta and dark apices to tergites. Legs black, tibiae brownish. Wings quite distinctly infuscated.

Frons almost linear; eyes normal; facial carina distinct but not prominent. Thorax with 2+4 dorso-centrals and 1+2 acrostichals. Abdomen ovate, fourth visible tergite with a transverse series of long discal bristles, and an elongate-oval patch of long closely-placed lanceolate bristles on each side at curvature. Mid-tibia without a ventral bristle, hind femur with a few long postero-ventral bristles. Curve of fourth vein subangular.

Length 10 mm.

*Type*, Kampala, Uganda, 17. xi. 1915 (*C. C. Gowdey*).

I have seen no other related species with the peculiar lateral patches of lanceolate bristles on fourth tergite.

*Strongyloneura natalensis*, Villeneuve.

A brilliant metallic blue-green species with entirely black legs and a subangular bend to fourth vein of wing.

Length 7–9 mm.

Many specimens from Natal.

LXV.—*A Revision of the Subfamilies of the Terebratulidæ (Brachiopoda).* By J. ALLAN THOMSON, M.A., D.Sc., F.G.S., Director of the Dominion Museum, Wellington, New Zealand.

THE family Terebratulidæ, which at one time embraced all the genera now included in both the superfamilies Rhynchonellacea and Terebratulacea, together with the Thecidiidæ of the Protremata, has undergone successive restrictions until it is now only a comparatively minor division of the Terebratulacea. Beecher (1893) placed the classification of the Terebratulacea upon a firm footing when he used the nature of the larval stages of the lophophore and the differing modes of loop development to divide the superfamily into the two families of the Terebratulidæ and Terebratellidæ. Within the family Terebratulidæ he recognised four subfamilies—the Centronellinæ, Stringocephalinæ, Terebratulinaæ, and Dyscoliinaæ. Schuchert (1913) has modified Beecher's scheme by recognising within the superfamily two divisions: (A) Terebratuloids, with the three families of Centronellidæ, Stringocephalidæ, and Terebratulidæ, the latter embracing the subfamilies Megalanterinaæ, Dielasmatinaæ, Terebratulinaæ, and Dyscoliinaæ, and (B) Terebratelloids, with the single family of the Terebratellidæ. The grounds on which Beecher's subfamilies and Schuchert's families and subfamilies of Terebratuloids are based are open to criticism, as will be seen below, and it seems best to recognise within the Terebratuloids the single family of Terebratulidæ, with a number of subfamilies.

Excluding a few Triassic genera, the post-Palæozoic Terebratulidæ are distributed by Schuchert, following Beecher, between two subfamilies, the Terebratulinaæ, Dall, characterised by a median unpaired coiled arm, and the Dyscoliinaæ, Beecher, characterised by the absence of a coiled median arm. Put in the terminology of Beecher (1897), the Terebratulinaæ have plectolophus lophophores, while the Dyscoliinaæ have lophophores in the trocholophus, schizolophus, or zugolophus stages. It is, of course, obvious that the distinction is only possible with recent genera, and some Mesozoic genera assigned to the Terebratulinaæ may really be Dyscoliinaæ. The recent genus *Chlidonophora*, however, which Schuchert assigned to the Terebratulinaæ, should have been placed in the Dyscoliinaæ, since it has a primitive lophophore, probably trocholophus.

This classification is based only on the stage of lophophore

attained, and is therefore open to criticism. Adapting an argument used by Buckman (1911) in regard to the loop stages attained by the genera *Terebratella* and *Magellania*, we may say of these subfamilies: Now as members of the *Terebratulinae* pass through stages of lophophore in their ontogeny comparable with the adult lophophores of the *Dyscolinae*, pointing to similar stages in their phylogeny, the names *Terebratulinae* and *Dyscolinae* thus used do not indicate proper subfamily divisions, but mark the stage of lophophore development attained. It is therefore more than likely that certain *Terebratulinae* are really *Dyscolinae* which have attained a plectolophus lophophore, and that certain *Dyscolinae* are really *Terebratulinae* which have not yet lost the trocholophus (schizolophus, or zugolophus) lophophore. This means that a re-arrangement of these subfamilies to correspond with vertical lines of descent instead of to indicate horizontal lines of development stages may be necessary.

The vertical lines of descent, fortunately, are indicated clearly enough by the types of cardinalia. In *Chlidonophora* and *Eucalthis* (olim *Dyscolinae*), and in *Terebratulina* (olim *Terebratulinae*), the cardinalia are characterised by the absence of hinge-plates or analogous structure between the socket-ridges, the dorsal pedicle muscles being attached directly to the floor of the valve. In *Dyscolia*, *Gryphus*\*, and *Terebratula*, on the other hand, there are distinct though narrow outer or divided hinge-plates between the socket ridges and crural bases, to which the dorsal pedicle muscles are attached. These differences were clearly pointed out by Fischer and Oehlert (1891, p. 20) when describing *Dyscolia*—“De plus, la région cardinale, par suite de la forme et du développement interne du rebord des fossettes, ne ressemble nullement à ce qu'on observe chez les *Terebratulina*, mais présente au contraire une grande analogie avec les types *Terebratula* et *Liothyryna*; comme dans ces genres, les muscles pédonculaires dorsaux s'insèrent sur le rebord interne des fossettes, au lieu de se fixer au fond de la valve comme dans les *Terebratulina* et les *Eucalthis*.” Hancock (1858) had made a somewhat similar distinction between *Terebratulina retusa* and *Magellania flavesceus*, in which latter species the pedicle muscles are attached to inner hinge-plates, remarking that in the former more extensive and livelier movements of the shell on the pedicle would be possible.

\* Dall (Proc. U.S. Nat. Mus. vol. lvii. 1920, pp. 310-11) has shown that the generic name *Gryphus*, Megerle, was wrongly suppressed, and this name should be restored in place of *Liothyryna*.

Now as the characters of the cardinalia have not hitherto been regarded as important in the Terebratulidæ, it may seem at first sight a little far-fetched to base a subfamily classification upon them. But it may be pointed out that the two types displayed by *Terebratulina* and *Terebratula* respectively are quite distinct and very persistent. Neither, so far as we know, is a development from the other, the gap between them is not bridged at any point, and the two types have persisted side by side since at least the Jurassic. Moreover, if the genera are divided according to this character, other characters will be found to fall into line, and the two subfamilies will be found to have much more an *air de famille* than was the case in the former grouping. The basis of classification is pragmatically justified because it works.

We may, therefore, recognise two subfamilies corresponding to vertical lines of descent, indicated by the types of cardinalia. For one of these the name Terebratulinae, Dall, based on *Terebratula*, is available, and must include *Dyscolia*, so that the name Dyscoliinae falls into synonymy. For the other it is not desirable to base a new subfamily name upon *Terebratulina* itself for two reasons: firstly, that there would be confusion in such similar names, and, secondly, that there is some doubt, according to Dall (1920), whether *Terebratulina* is a valid name for the group for which it is currently employed. I propose, therefore, for the new subfamily the name CANCELLOTHYRINÆ, based upon *Cancellothyris*, gen. nov., type *Terebratula cancellata*, Koch, a recent Australian species. This genus is distinguished from *Terebratulina* by the possession of epithyrid beak-characters and a symphytium, and represents the highest development in the subfamily both in regard to beak-characters and lophophore.

The genera of the Cancellothyrinæ may be arranged as follows:—

Lophophore subplectolophus; shell biconvex.	
Hypothyrid .....	<i>Chlidonophora</i> .
Hypothyrid with tubular beak .....	<i>Agulhasia</i> .
Submesothyrid .....	<i>Eucalathis</i> .
Lophophore plectolophus.	
Shell planoconvex to sulcate:	
Hypothyrid .....	<i>Disculina</i> ; <i>Murravia</i> .
Shell biconvex to sulciplicate:	
Submesothyrid ...	<i>Terebratulina</i> .
Epithyrid .....	<i>Cancellothyris</i> .

The *air de famille* of the above genera is clearly evident from the fact that species of all of them, excepting perhaps *Disculina*, have at one time or another been referred to the



genus *Terebratulina*. All agree in the possession of a capillate ornament of a special type and in a peculiarity of the punctation of the test, viz., the regular branching of the pores towards the outer surface. In the cardinal margin they show a progression from the megathyrid stage (*Chlidonophora*), through the submegathyrid (*Eucalathis*), to a stage almost terebratulid (*Terebratulina*), but distinguished by the retention of an alate dorsal valve, to which the name of subterebratulid stage may be given. In loop characters the more primitive genera have simple short loops somewhat resembling those of the genera of the subfamily Terebratulinae, but the higher genera (*Murravia* to *Cancellothyris*) possess a type of loop peculiar to this subfamily, characterised by the transformation of the loop into a ring supported by the crura, owing to the union of the crural processes into a second transverse band.

The subfamily Terebratulinae, as redefined by the type of cardinalia, still contains most of the genera originally placed in it with the addition of *Dyscolia*, and does not compose quite such a homogeneous group as the Cancellothyridae. The majority of the genera are smooth and devoid of ornament, but there are capillate members with terebratulid cardinal margins such as *Dyscolia*, *Trichothyris*, *Holcothyris*, and probably other as yet unnamed genera in the Cretaceous. A study of their loops may perhaps give confirmative grounds for the grouping together of these capillate genera as a distinct section of the Terebratulinae or as a distinct subfamily. Among the smooth genera, the majority of which possess terebratulid cardinal margins, there are a few with megathyrid or submegathyrid cardinal margins such as *Orthotoma*, *Tegulithyris*, *Linguithyris*, and *Nucleata*. Until their cardinalia and loops have been investigated it must remain uncertain whether these genera are true Terebratulinae, as is most probable since the difference in cardinal margin is a difference in development only, or form a smooth section in the Cancellothyridae. The character of their punctation would be a useful test of the latter possibility in the event of suitable interiors for the study of the cardinalia being unavailable. In addition there are rugose and ornate members of the Terebratulinae.

When we turn to the Palaeozoic and Triassic Terebratuloids we find that the grounds given by Schuchert for the distinction of the Centronellidae and Terebratulidae are open to the same sort of criticism as has been used above for the subfamilies Terebratulinae and Dyscoliinae. The Centronellidae are defined as "primitive Terebratuloids with short loops developing direct, and composed of two descending

lamellæ, uniting in the median line and forming a broad arched plate." The Terebratulidæ are defined as "Terebratuloids developing originally a *Centronella*-like loop, and thence by a short series of metamorphoses resulting at maturity in a free loop of various form." These distinctions are based solely on the stage of loop attained, and it is probable that some Terebratulidæ are really Centronellidæ which have progressed to the *Dielasma* or *Megalanteris* loop stage, and some Centronellidæ are really Terebratulidæ which have not yet passed the *Centronella* loop stage.

As the cardinalia have proved so useful an index of vertical lines of descent in the recent and Tertiary members both of Terebratelloids and Terebratuloids, it may be expected that they will prove equally trustworthy in the Palæozoic Terebratuloids. I have not had the opportunity of making direct studies of interiors of these brachiopods, but certain details can be gleaned from Hall and Clarke (1894) which seem to indicate the lines on which revision may proceed.

There are at least four well-marked types of cardinalia among the genera in question. *Centronella* possesses divided hinge-plates, apparently quite similar to those of *Dyscolia*, *Gryphus*, and other genera of the Terebratulinae. This type, therefore, must have persisted between the Devonian and Jurassic, and probably occurs in some genera of the Dielasmatinae, such as *Nucleatula*. It does not seem advisable, however, to place *Centronella* in the Terebratulinae, for the recent genera of this subfamily, unlike *Dielasma*, do not develop a *Centronella* loop stage with a median arched plate, but appear to proceed directly to the *Terebratula* loop stage; the *Centronella* stage has been lost by tachygenesis. The subfamily Centronellinae may therefore be retained for genera with divided hinge-plates developing a *Centronella* loop stage, and probably includes genera such as *Nucleatula* in the *Dielasma* loop stage.

A very distinctive type of cardinalia in Palæozoic Terebratuloids is that characterised by inner hinge-plates uniting anteriorly in the middle line, but perforated posteriorly by the so-called visceral foramen, which has been interpreted by Beecher as a passage for an anus opening near the delthyrium\*. This foramen often becomes filled in later stages of growth, which, if Beecher's contention as to its significance is correct, would be due to the closing of the delthyrium and the atrophy of the anus. The adductor

\* A similar visceral foramen occurs in *Athyris* (Spiriferacea), but, as this genus has an impunctate test, it must be regarded as a case of homœomorphy.

muscles are attached to the floor of the valve in front of the hinge-plates. This type is distributed in Schuchert's classification as follows:—

Centronellidæ: *Amphigenia*, *Rensselaeria*, *Beachia*,  
*Trigleria*.

Dielasmatinæ: *Cranæna*, *Notothyris*.

Megalanterinæ: *Cryptonella*.

The long loop of *Cryptonella* (and *Megalanteris*) resembles that of the recent Terebratuloid genus *Macandrevia*, but, unlike it, has probably not developed in connection with a median septum but directly from the *Dielasma* loop stage, and represents the highest form of loop development in Terebratuloids. This remains to be definitely proved by direct ontogenetic studies, but is rendered practically certain by the presence of the visceral foramen in *Cryptonella*. We may, therefore, with fair confidence include all these genera in a new subfamily CRYPTONELLINÆ.

A third, very distinctive, type of cardinalia is displayed by *Dielasma*, which possesses between the crural bases a more or less elevated cruralium, a plate which, unlike hinge-plates, serves for the attachment of the adductor muscles as well as of the dorsal pedicle muscles. In other related genera such as *Beachia* the cruralium is practically sessile, and it is conceivable that it is by its atrophy that the type of cardinalia displayed by the Cancellothyridinæ has arisen. The possession of cruralia appears to be confined to genera in the *Dielasma* loop stage, and for these the subfamily Dielasmatinæ may be retained.

A fourth type of cardinalia is that possessed by *Megalanteris*, in which the space between the crural bases is filled by a solid hinge-platform, supporting posteriorly a thickened cardinal process. A somewhat similar type is displayed by *Ariskania*, which possesses presumably a Centronelliform loop. Possibly this type has arisen from the type with inner hinge-plates by callous growth, but as the subfamily name Megalanterinæ is in existence it may be provisionally retained for these genera.

There remains for consideration the genus *Stringocephalus*, the sole example of the family Stringocephalidæ. The prior question arises of whether this genus is correctly placed amongst the Terebratuloids. Schuchert states that the development of the loop is direct, which is presumably the reason why it is placed amongst the Terebratuloids and not the Terebratuloids. But, as the loop follows the margin of the valve and is not recurved in front, the lophophore must have been in the trocholophus stage, and the loop development must necessarily be direct. The metamorphoses of

the Terebratelloid loop do not begin until the schizolophus stage is reached or passed. Since the loop follows the margin of the valve, the cirri must have been directed inwards, as in Terebratelloids, whereas in Terebratuloids in the trocholophus stage the cirri are directed outwards. The genus, therefore, must be excluded from the Terebratuloids. The difficulty in placing it amongst the Terebratelloids is its geological age, for the genus is Devonian, whereas the oldest Terebratelloids are Jurassic or possibly Triassic (*Aulacothyris*). A similar difficulty has probably led Schuchert to transfer the Devonian *Tropidoleptus* from the Terebratellidæ to the Strophomenacea (Protremata). *Stringocephalus* possesses one feature more characteristic of Protremata than of Telotremata, namely, the presence of a chilidium in the dorsal valve, covering a dorsal delthyrium, but the closing of the ventral delthyrium by deltidial plates definitely places the genus in the Telotremata as at present defined.

*Tropidoleptus* also possesses a chilidium, but the ventral delthyrium remains unclosed through all stages of growth. In loop characters *Tropidoleptus* presents the greatest similarity to the recent Terebratelloid *Magasella incerta*, Davidson, a species whose generic and subfamily position is uncertain, although Fischer and Oehlert have referred it to *Platidia*. It seems best in the present state of our knowledge to include both *Stringocephalus* and *Tropidoleptus* in the Terebratulacea, but to exclude them from both the Terebratulidæ and Terebratellidæ and regard them as primitive aberrant types of Terebratulacea which have not given rise to further developments.

#### SUMMARY AND DEFINITIONS.

All the Terebratuloids, as understood by Schuchert, are placed in a single family, the Terebratulidæ, Gray, with the single exception of *Stringocephalus*, and the following subfamilies are recognised :—

Centronellinæ, Waagen.—Terebratulidæ with short loops attaining or passing through a *Centronella* loop stage ; cardinalia with divided hinge-plates.

Cryptonellinæ, nov.—Terebratulidæ with loops attaining or passing through the *Centronella*, *Dielasma*, or *Cryptonella* loop stages ; cardinalia with inner united hinge-plates, perforated posteriorly by a visceral foramen.

Megalanterinæ, Waagen.—Terebratulidæ with loops attaining or passing through the *Centronella*, *Dielasma*, or *Cryptonella* loop stages ; cardinalia with an elevated hinge-platform and high cardinal process.

Dielasmatinæ, Schuchert.—Terebratulidæ with loops of

the *Dielasma* loop stage; cardinalia with excavate or sessile cruralia.

Terebratulinae, Dall.—Terebratulidae with short loops not passing through a *Centronella* loop stage; cardinalia with divided hinge-plates.

Cancellothyridae, nov.—Terebratulidae with short loops passing through or attaining the *Chlidonophora*, *Eucalathis*, or *Terebratulina* loop stages; cardinalia characterised by the absence of hinge-plates and the attachment of the dorsal pedicle muscles to the floor of the valve.

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#### LXVI.—On new Neotropical Curculionidae (Col.).

By GUY A. K. MARSHALL, C.M.G., D.Sc., F.R.S.

#### Subfamily OTIOREHYNCHINÆ.

*Artipus calceatus*, sp. n.

♂ ♀. Integument black, with uniform dense whitish-grey scaling above and below.

*Head* finely rugulose beneath the scaling; the forehead somewhat flattened and with a short deep median furrow; the eyes hemispherical. *Rostrum* parallel-sided, about as

long as the head, much broader than long; the dorsum broadly and deeply excavated, subcostate laterally; the scrobes much dilated behind, closely approaching the eyes in ♂, less so in ♀, their upper edge bent downwards at almost a right angle. *Antennæ* with the scape exceeding the hind margin of the eye, densely squamose and with recumbent white setæ; the funicular joints in order of length: 1, 2, (3, 4,) (5, 6, 7), all longer than broad. *Prothorax* about as long as broad in ♂, slightly transverse in ♀, gently rounded at the sides, broadest at the middle, and shallowly constricted near the apex, which is only slightly narrower than the base; the dorsum rugosely punctate, but the sculpture almost entirely hidden by the overlapping scales; the white setæ short, sparse, and recumbent. *Scutellum* transverse and densely squamose. *Elytra* parallel-sided from the roundly rectangular shoulders to beyond the middle and shortly acuminate behind; the punctures in the shallow striæ clearly indicated, although they are almost entirely covered by the overlapping scales, which are not arranged star-wise round them; intervals 1, 3, 5, 7 very slightly higher than the others, but the suture not markedly elevated on the declivity; each interval with a row (sometimes rather irregular) of short adpressed white setæ. *Legs* with dense overlapping scales and sparse sub-recumbent setæ.

*Length* 5.1–6.6 mm., *breadth* 1.8–3 mm.

HAITI: Port au Prince, ii.-iii. 1925, on *Trichopteris rigida* and *Parthenium hysterophorum* (G. N. Wolcott).

Described from a pair.

Nearly allied to *A. psittacinus*, Gyl., which differs in being entirely green above, and having interval 5 on the elytra markedly elevated at the base; the eyes are also less prominent, and the space between the eye and the prothorax is about equal to the length of the eye, whereas in *A. calceatus* it is much shorter than the eye.

*Lachnopus gowdeyi*, sp. n.

♂ ♀. Integument yellow-brown to red-brown; rather thinly clothed above and below with grey scales having a strong coppery reflection, with scattered small spots of whitish scales along the striæ (less distinct in ♂), a small bare patch (usually darker than the ground-colour) a little before the middle on interval 4 (obsolete in ♂) and a larger irregular one behind the middle on intervals 3 and 4 (reduced in ♂); beyond stria 2 the dorsum is sometimes covered (in ♀ only) with dense whitish scales from one-sixth

from the base to the apex, the area being quite indefinite externally, but well defined internally and there sharply excised by the two bare patches; more often this whitish area is much restricted in its anterior two-thirds, forming a narrow irregular stripe partly on intervals 3, 4, and 5, or broken into separate patches.

*Head* with fine separated punctures and sparse narrow scales, and without any transverse impression; the eyes flat, their curvature being continuous with that of the head and a little deeper than long (6 : 5); the forehead almost flat, much narrower than the interantennal area (2 : 3), with shallow subconfluent punctures and a deep median fovea. *Rostrum* about as long as the head and gradually widening from base to apex; the dorsum convex transversely, with a shallow longitudinal impression on each side, the outer edges of which are subcostate and converge towards the base, the median area with close shallow punctation in ♂, more sparsely punctate and shiny in ♀, and feebly costate; the apical declivity quite flat transversely and not excavate; the scrobes broadly dilated behind, owing to the upper edge being much less deflexed than usual and running to the middle of the eye, so that it is practically visible throughout its length from above. *Antennæ* with the scape reaching the base of the eye; the funicular joints in order of length : 2, 1, 3, 4, (5, 6, 7), the distal joints being much longer than broad and clavate. *Prothorax* strongly transverse in ♀ (3 : 2), rather narrower in ♂, almost parallel-sided from the base to near the middle, then roundly narrowed to the apex without any definite constriction; the dorsum unusually flattened in the middle and with a broad deep transverse depression in the basal half and a short median stria or fovea in front of it; the punctation fairly close and distinct in ♀, less strong in ♂, and a small round fovea on each side of the transverse impression; the scales at the sides almost circular, and a few similar scales along the median line, the other discal scales narrower. *Elytra* broadly ovate in ♀, parallel-sided from the shoulders to beyond the middle, sharply acuminate behind, and separately rounded at the apex; much narrower and more gradually acuminate in ♂; the shallow striæ with distinct separated punctures, which become smaller on the declivity; the intervals almost flat, with minute shallow punctures for the attachment of the scales, some additional punctures on the bare patches which make the striæ seem irregular there, two intercalated rows of punctures between striæ 5 and 6, and two more behind the middle between 6 and 7; the whitish scales rather larger and densely overlapping, the others hardly

contiguous near the suture, but denser laterally; the setæ very short, recumbent, and irregular. *Legs* concolorous, evenly and fairly densely covered with mostly narrow pale scales, and with sparse short subrecumbent setæ (even on the tibiæ); the hind tibiæ of ♂ with only a few minute granules on the inner face and without the usual dense fringe of long soft hairs.

*Length* 7·8–10·8 mm., *breadth* 3–4·5 mm.

JAMAICA: Cinchona, vii. 1923, 2 ♂♂, 5 ♀♀ (*C. C. Gowdey*).

The colouring, combined with the flattened apex of the rostrum, the unusually dilated scrobes, the deeply impressed pronotum, and the intercalated punctures on the elytra should make this species easily recognisable.

*Lachnopus wolcottii*, sp. n.

♂ ♀. Integument black or piceous; the head with a patch of elongate whitish scales beneath each eye; the prothorax with a narrow median stripe of similar scales, an indefinite and much sparser one on each side, and an abbreviated one on the pleuræ (the last two usually abraded); the elytra with a macular stripe of whitish or yellowish scales on interval 2 from the base almost to the declivity, and also incomplete and variably interrupted stripes on intervals 8 and 9, and (in ♀ only) a thin tuft of erect white hairs at the top of the declivity; the lower surface with white scaling in the middle of the metasternum and on the anterior face of the coxæ, a narrow white stripe on each side of the metasternum, and two broad sublateral stripes on the two basal ventrites.

*Head* with the forehead much flattened, wider than the interantennal area (4:3), and shallowly striolate or with large longitudinally confluent punctures, the vertex with finer closer punctures which are often longitudinally confluent; the eyes longitudinal, ovate, and scarcely projecting beyond the outline of the head. *Rostrum* shorter than the head and only a little longer than the eyes, parallel-sided; the dorsum strongly flattened longitudinally and transversely, so that the sublateral carinæ, which are sharp and distinct, are not very much higher than the upper edges of the scrobes, and with a broad median depression in ♂, which is almost obliterated in ♀; the interantennal area shallowly impressed; the scrobes aberrant, being only slightly curved and running back to the upper half of the front margin of the eyes. *Antennæ* with the scape slightly exceeding the hind margin of the eye; the funicular joints in order of length: (1, 2,) 3, 4, (5, 6, 7). *Prothorax* a little shorter



than its basal width (5 : 6), broadest at the base and strongly narrowed to apex, the sides being only slightly curved; the base bisinuate, the apical margin truncate, its dorsal half with a fringe of short white setæ, the lower half with a fringe of longer setæ mingled with elongate scales; the dorsum smooth and shiny, with sparse fine shallow punctures and scattered larger ones; sparsely set with whitish setiform scales in addition to the three stripes. *Scutellum* subtriangular, finely and shallowly punctate, and with a shallow impression in the middle. *Elytra* widest at the shoulders and very gradually narrowed behind, being more acuminate at the apex in ♂ than in ♀; the striæ very shallow and containing rows of large shallow punctures, but the elytra appearing to be multistriate owing to the intercalation of two rows of similar punctures on intervals 2, 4, and 6, but the typical striæ readily discernible at the extreme base; the spots of the macular stripe on interval 2 lying in shallow depressions; the intervals almost flat, with fairly close fine shallow punctation, and each with a widely spaced row of short subrecumbent white setæ; the dorsal outline rising slightly at the base and then almost flat to the top of the declivity, which is almost perpendicular in ♀ and less steep in ♂. *Legs* black or red-brown, with fine scattered punctures; the femora with scattered short subrecumbent setæ and sparse narrow white scales, and broader ones forming a dense oblique patch near the apex, the lower surface with small sparse granules in ♂ only; the posterior tibiæ of ♂ straight, with short teeth and long silky white hairs on the inner side, the teeth replaced by small granules in ♀ and the hairs shorter and stiffer.

*Length* 11.4–14.4 mm., *breadth* 3.9–5.1 mm.

HAITI: Gonaives, 29. vii. 1924, on *Casearia illicifolia* (G. N. Wolcott). ST. DOMINGO (type).

Described from nine specimens.

This aberrant form may be distinguished from all the previously described species of *Lachnopus* by its very short and much flattened rostrum, the unusually straight scrobes, the very flat eyes, and the additional rows of punctures on the elytra.

*Lachnopus histrio*, sp. n.

♂ ♀. Integument black, with dense pale bluish-grey scaling above and chalky-white beneath; the prothorax on each side with a broad whitish stripe, which unites narrowly with the white of the underside along the basal and apical margins: the elytra with the following whitish markings:

a subquadrate basal patch extending from stria 1 to a little beyond 3, occasionally also a short basal stripe on interval 5, an oval patch at the apex of interval 5, a short stripe at the apex of interval 3, uniting with a slightly longer stripe at the apex of intervals 9 and 10, and sometimes a rather indefinite sutural patch on a low prominence on the declivity; a whitish subapical patch on the anterior face of all the femora.

*Head* with shallow separated punctures (hidden by scaling), convex on the vertex; the forehead flattened and with a small median fovea, almost as broad as an eye in ♀, much narrower in ♂; the eyes large and quite flat, not projecting beyond the curvature of the head. *Rostrum* much shorter than the head, about as broad as long, parallel-sided; the dorsum quite flat in the basal half, the close shallow punctation hidden by the scaling, the anterior half sloping steeply, shallowly impressed, with rather coarse punctation and with a feeble median costa; the scrobes short, gradually widening behind, the upper edge running straight to the eye and joining it well above its middle. *Antennæ* with the scape just reaching the hind margin of the eye; the funicular joints in order of length: 1, 2, 3, (4, 5, 6,) 7, joints 4-6 being as long as broad and 7 slightly transverse. *Prothorax* nearly as long as broad in ♂, parallel-sided from base to middle, then roundly narrowed to the apex, shallowly bisinuate at the base and truncate at the apex; the dorsum strongly convex longitudinally, highest at one-third from the base, without any impressions; the small subcircular grey scales on the disk closely placed but for the most part not actually contiguous, those in the lateral whitish stripes much larger and overlapping. *Scutellum* subquadrate, with dense whitish scaling. *Elytra* ovate, with prominent subrectangular shoulders, constricted laterally before the apex and with a transverse flattened area around the scutellum; the shallow striæ with distinct separated punctures which become smaller behind; the intervals broad and flat, and sometimes a slight sutural elevation on the declivity; the scales like those on the pronotum, the setæ irregular, very short, scale-like, recumbent and inconspicuous. *Legs* piceous, densely squamose; all the tibiæ with a row of stout teeth internally in both sexes, and the setæ on the hind pair also the same in the two sexes.

*Length* 5.4-6.6 mm., *breadth* 2.1-3 mm.

HAITI: Port au Prince, v. 1925, on yellow-flowered composite shrub with prickly leaves (*G. N. Wolcott*).

A constant and very distinctively coloured species. The

markings somewhat resemble those of *Prepodes* (*Exophthalmus*) *cinerascens*, F., and the present species sometimes stands under that name in collections.

*Lachnopus histrio*, var. *erectosetosus*, nov.

♀. Differs from the typical form in its larger size, brownish-grey (instead of bluish-grey) scales, and especially in the much longer, erect or suberect setæ on the elytra.

Length 7·8–9 mm., breadth 3·3–3·9 mm.

HAITI: No exact locality, 1858 (*J. Gray*).

*Eustylus magdalenæ*, sp. n.

♂ ♀. Integument black, with dense scaling, which is sandy-brown above and dirty chalky-whitish beneath; the elytra with the dorsal brown colouring ceasing laterally at stria 6, interval 3 paler and bearing an elongate brownish-black patch slightly before the middle and a second longer one at the top of the declivity, another patch (of the same size as the anterior one) behind the middle on interval 7, and a slight darker clouding behind the middle on interval 5 and at the top of the declivity on interval 1 (in the second specimen these posterior patches are more strongly marked and more or less united so as to form an irregular oblique band).

*Head* not impressed behind the eyes, which are moderately prominent. *Rostrum* as long as its greatest width, parallel-sided near the base and strongly dilated at the apex, the interscrobial area deeply impressed, and the margin of the epistome sharply elevated. *Antennæ* with the scape subcompressed, only slightly curved, and with the setæ subrecumbent; the funicle with the two basal joints subequal. *Prothorax* slightly broader than long, parallel-sided from the base to the middle, then gradually narrowed to the apex, the apical constriction almost obsolete; the dorsum even with the punctures hidden by the scaling; the scales fluted and flat, except along the middle line, where their apices are turned upwards; the setæ curved and obliquely raised. *Scutellum* subquadrate, slightly transverse. *Elytra* a little dilated behind the middle, markedly constricted at the base, the basal margin only feebly sinuate in the middle; the shallow striæ with deep separated punctures, which are distinctly visible through the scaling; the intervals gently convex, the alternate ones being slightly more raised, but less so in ♀; the scales fluted, densely overlapping, and recumbent; the setæ rather long, suberect, truncate, and

darker than the scaling. *Legs* with uniform dirty white scaling; the front femora with an obtuse tooth.

*Length* 7.5 mm., *breadth* 3-3.3 mm.

COLOMBIA: El Blanco, Magdalena Valley, 1 ♂ (*C. Allen*); Aracataca, Magdalena, 13. viii. 1920, 1 ♀, in deep forest (*M. Hebard*).

The female specimen was kindly given to me by Mr. Frank R. Mason, of Philadelphia.

Very closely allied to the Central American *E. sexguttatus*, Champ., which differs only in having the scutellum subpyriform and a little longer than broad, and the setæ on the pronotum and elytra are paler, distinctly shorter, broader, and closely recumbent.

*Exorides bifurcatus*, sp. n.

♂. Integument black, clothed with pale green scaling, which on the head, rostrum, legs, and the apices of the elytra becomes still paler with much coppery reflection; the lower surface uniformly pale green.

*Head* with very scattered larger punctures and numerous smaller ones between them; the frontal fovea elongate and shallow, and the ocular margins not impressed. *Rostrum* about as long as its basal width, almost parallel-sided; the median furrow deep and subtriangular, connected with the frontal fovea by a very shallow stria, the two outer furrows deep, elongate, and longitudinal, the two intervening costæ (when abraded) closely and finely punctate; the apical depression deep and semicircular. *Antennæ* with the scape extending slightly beyond the eye and densely clothed with lanceolate scales and with sparse long obliquely-raised setæ; the funicular joints in order of length: 2, 1, 3, (4, 7,) (5, 6), the apical joints being much longer than broad. *Prothorax* distinctly longer than broad, subcylindrical, being only slightly narrowed near the apex; the basal margin shallowly bisinuate, the apical margin truncate dorsally and broadly sinuate beneath; the dorsum coarsely foveolate throughout, without tubercles, and flattened on the disk; the floor of the foveæ bare, the interspaces densely covered with almost circular green scales. *Scutellum* completely enclosed in front by the base of the elytra, pear-shaped and densely squamose. *Elytra* very narrow and elongate, widest at the middle, the shoulders only slightly projecting and separated by a constriction from the rounded basal angles, the apical processes very long and sharp and directed slightly upwards; the dorsum almost flat in outline and with a slope of about 40° on the declivity, coarsely punctate

in regular rows; the intervals narrow, sinuous, and indefinite, 3 somewhat obtusely elevated at the top of the declivity, 7 raised from the base to beyond the middle, and 5 for a short distance behind the middle; long suberect setæ on the apical processes, but none on the disk. *Legs* densely squamose and with scattered raised setæ; the tibiæ not denticulate internally, and the hind pair with a distinct apical mucro; the second joint of the front tarsi about as long as broad.

*Length* (including apical processes) 15.5 mm., breadth 3.9 mm.

COLOMBIA: Cincinnati Trail, Sierra de S. Lorenzo, 4000–6000 ft., Magdalena, 16. vii. 1920, 1 ♂ (*F. R. Mason*).

In general facies closely resembling *E. cylindricus*, Mshl. (Trans. Ent. Soc. Lond. 1922, p. 213, pl. iv. fig. 8), and agreeing with it in having an apical mucro on the hind tibiæ, but differing in the long apical processes and the basal constriction on the elytra; it differs also from the known species of the genus in the enclosure of the scutellum and in having lanceolate scales on the antennal scape.

#### Subfamily *ERIERHININÆ*.

##### *Spermologus impressifrons*, sp. n.

♂ ♀. Integument blackish or piceous, uniformly and rather thinly clothed with subrecumbent or obliquely raised golden-brown setiform scales, sometimes intermingled with blackish ones.

*Head* with large separated punctures, the forehead broader than the base of the rostrum and separated from it by a broad shallow transverse impression; the eyes sharply acuminate below and separated by about the width of the antennal club. *Rostrum* about as long as the head and pronotum in both sexes, deflected backwards in the normal position, almost straight, strongly narrowed from the base to the middle, and gradually widening from the middle to the apex, being slightly dilated at the insertion of the antennæ, which are placed at the middle in ♀ and beyond it in ♂; the dorsum with six shallow punctate sulci in the basal half, the intervals being subcarinate, the apical half with fairly regular rows of strong punctures, which are larger and subconfluent in ♂. *Antennæ* stout, piceous; the funicular joints in order of length: (1, 2,) 7, (5, 6,) 4, 3, the intermediate joints subcylindrical and longer than broad, 7 nearly as long as the club. *Prothorax* much broader than long, strongly rounded at the sides, widest at about three-fourths from the base, abruptly narrowed in front and

constricted at the apex, rapidly narrowing towards the base, which is feebly bisinuate; the dorsum gently convex longitudinally, almost flat transversely on the basal half, set throughout with large shallow reticulate punctures and with a low median carina that does not reach base or apex; each puncture with a broad subrecumbent brown seta. *Elytra* subquadrate, only a little longer than broad (6:5), jointly sinuate at the base, with the shoulders prominent and roundly rectangular, almost parallel-sided from there to the middle, then gradually narrowing, and broadly rounded behind; the dorsal outline gently convex, highest at about the middle and steeply declivous behind; the striæ deep and with strong separated punctures throughout, the intervals broader, almost flat, and somewhat rugulose; a deep foveate impression below the feeble posterior calli. *Legs* stout, coarsely punctate, and with short stout golden setæ.

*Length* 5.4 mm., *breadth* 3 mm.

BRAZIL: Bahia, 1925, 2 ♂♂ 1 ♀, bred from fruits of *Camphora* (Dr. G. Bondar).

Very similar in general appearance to *S. rufus*, Boh., the only species known hitherto, which Dr. Bondar has found breeding in seeds of cacao. The latter species is rather larger, with the prothorax less narrowed behind, more convex transversely, the punctures smaller and the intervals between them wider, the faint median carina confined to the anterior half and reaching the apex, and a shallow longitudinal impression in the middle of the base; the antennæ are inserted at the middle of the rostrum in ♂ and behind it in ♀; and the eyes are less acuminate beneath and a little closer together. Lacordaire states that the eyes are contiguous beneath in *S. rufus*, but this is incorrect; and it is possible, from his remark that the insect at first sight appears glabrous, that he had before him the following species, and not *S. rufus*. It is true that in his specific description Boheman describes the eyes as "inferne connexi," but Schoenherr in his generic description records them as "approximati."

*Spermologus breviscapus*, sp. n.

♂. Piceous black; the dorsum apparently bare, but having very small recumbent blackish scales or setæ within each puncture and not exceeding it; the lower surface with fairly dense, recumbent or subrecumbent, fulvous scales, but these very much reduced in the median area of the venter.

*Head* coarsely and rather rugosely punctate, with a deep median fovea, but without any transverse impression; the

eyes subcontiguous beneath. *Rostrum* about as long as the head and pronotum, proportionately more slender than in the other two species, subcylindrical, widening only at the base and apex, not dilated at the insertion of the antennæ, which are placed at only one-fifth from the base; the dorsum bearing strong punctures in irregular rows and a smooth median line throughout, with two shallow admedian furrows in the post-antennal section, and a lateral furrow from above the antennæ almost to the apex. *Antennæ* with the scape unusually short, scarcely as long as the two basal joints of the funicle together; these joints equal, the remainder very short and more or less transverse; the club short, subglobose, and scarcely wider than the 7th funicular. *Prothorax* transverse, rounded at the sides, widest in front of the middle, abruptly constricted at the apex and shallowly bisinuate at the base; the dorsum moderately convex transversely, with the lateral margins much more sharply angulated than in the other two species, fairly closely set with shallow separated circular punctures, each containing a minute flattened seta, the smooth median line not reaching the base or apex; the pleuræ smooth and with widely separated punctures. *Elytra* very broadly ovate (10:9), shaped like those of *S. impressifrons*, but with the sides a little more rounded and the dorsal outline more convex; the broad shallow striæ containing scarcely perceptible punctures, indicated by rows of minute adpressed setæ, appearing like shiny granules; the intervals broad, almost flat, each with a somewhat irregular row of larger punctures containing a short adpressed seta (the setæ longer and suberect on the declivity) and scattered minute ocellated punctures. *Legs* stout, with scattered punctures and fulvous scales, the scaling denser on the dorsal edges, and with suberect setæ.

*Length* 7·8–8·7 mm., *breadth* 4·8–5·4 mm.

**BRAZIL:** Jatahy, Goyas Province, 2 ♂♂ (*Pujol*).

Readily distinguished from the other two species of *Spermologus* by its smooth surface, shallow ocellated punctures, subcontiguous eyes, the position of the antennæ, and the very short scape.

#### Subfamily CHOLINÆ.

##### *Cholus martiniquensis*, sp. n.

♂. Integument blue-black, with markings formed of fulvous scaling; the prothorax fulvous above and below, except for a broad indefinite denuded median dorsal stripe and a longitudinal patch at each posterior angle composed

of flattened shiny tubercles with a few whitish scales between them; the elytra with three about equally broad (1.5 mm.) regular transverse fulvous bands, the first more or less interrupted between striæ 6 and 8 and separated dorsally from the base by about 1 mm., and similar spaces between the bands, the posterior band not reaching the apex, but the front band continued laterally to the base: the spaces between the bands and at the base mottled with small patches of whitish scales; the lower surface shiny black, with the sides of the metasternum (including the metepisterna) and the whole of ventrite 2 (4) densely covered with fulvous scales; the mesosternum, coxæ, and ventrite 1 (3) with sparse white or yellowish scales.

*Head* very shiny, with a few sparse punctures and some scattered white scales laterally; the forehead much narrower than the base of the rostrum, with a shallow median furrow ending in a small fovea. *Rostrum* long, slender, and strongly curved, longer than the head and prothorax, very slightly narrowing from the base to the antennæ, and thence gradually widening to the apex; the dorsum smooth, bare, without furrows or carinæ, and sparsely set with fine separated punctures arranged in irregular rows. *Antennæ* slender, red-brown; the funicle with joint 1 longer than 2 + 3, the joints in order of length: 1, 2, 3, 4, 6, (5, 7). *Prothorax* transverse (5 : 8), widest at the base, roundly narrowing to the apex, and there shallowly constricted; the dorsum with the median bare area set with large shallow punctures containing a few scales, and along the lateral margin low flattened tubercles appear through the scaling. *Scutellum* longer than broad, parallel-sided, broadly rounded behind, shiny, and with a few minute punctures. *Elytra* elongate, subelliptical, subtruncate at the base, and there scarcely wider than the prothorax, without any trace of humeral prominences, gradually narrowing from near the base to the apex, and there jointly and broadly rounded; the striæ only faintly indicated and almost obliterated near the base owing to the punctures being transversely confluent; the punctures large and distinct in the basal half, but becoming shallow and indefinite behind; the intervals ill-defined, set on the bare areas with small depressions containing white scales, and without conspicuous setæ. *Legs* black, the femora with a dark steel-blue reflection, set with sparse minute punctures containing minute recumbent setæ; the front tibiæ with an angulation on the inner edge at one-fourth from the base.

*Length* 13.5 mm., breadth 5.7 mm.

MARTINIQUE: ix. 1925, 1 ♂ (*G. N. Wolcott*).



I am much indebted to Mr. Wolcott for this handsome insect, which appears to be the first *Cholus* recorded from Martinique, where it represents *C. zonatus*, Swed., 1787, which occurs in Guadeloupe and Dominica. In the latter species the bare spaces on the pronotum and elytra are much broader, quite bare, and smoother, the intervals on the elytra lacking the scale-filled depressions; the first band on the elytra is narrower than the others, not interrupted, and does not reach the base on the lateral margin; the posterior half of the prosternum is devoid of fulvous scaling; and the apical portion of the median lobe of the male ædæagus is comparatively flat and a little narrower than the widest part of the tube; whereas in *C. martiniquensis* it is deeply concave and a little wider than the tube.

#### Subfamily TACHYGONINÆ.

##### *Tachygonus gowdeyi*, sp. n.

♂ ♀. Shining black, with a few pectinate white scales along the sides and posterior angles of the pronotum, and a dense, obliquely raised tuft of similar scales near the base of interval 1 on the elytra; the anterior pairs of legs red-yellow, with the tarsi piceous and the coxæ black; the hind pair with the basal half of the femora red-yellow, the apical half and the whole of the tibiæ black, the hind tarsi piceous and the coxæ black; the underside with pectinate white scales at the sides of the sternum and abdomen.

*Prothorax* subpentagonal, somewhat transverse, the sides only slightly rounded and scarcely constricted at the apex; the base obliquely truncate on each; the dorsum slightly convex longitudinally, with strong separated punctures, usually leaving a smooth median stripe, without any tufts, but sparsely set with long black setæ. *Elytra* broadly cordiform, slightly transverse, widest behind the shoulders, rapidly narrowing posteriorly, and broadly rounded at the apex, seriato-foveolate, the intervals narrow and smooth, the alternate ones being a little broader, rather sparsely set throughout with long erect black setæ, except for a row of remote white ones on interval 1. *Pygidium* with dense erect white setæ. *Legs* short, the hind femora only slightly exceeding the body and bearing two sharp teeth; the hind tibiæ not dilated and with the dorsal edge shallowly sinuate in the apical half; the anterior pairs of femora with recumbent white hairs and pectinate scales, and with a few long black setæ at the apex, the hind pair with long erect black

setæ on the black apical half and white ones on the basal half.

Length 1·8 mm., breadth 1·2 mm.

SAN SALVADOR: La Cula, iii. 1926, numerous specimens (C. C. Gowdey).

In shape, sculpture, and the post-scutellar tufts extremely similar to *T. centralis*, Lec., from Arizona, but that species may be readily distinguished by the fact that the femora are all black and the hind pair are merely serrulate and without long teeth.

LXVII.—*The Local Races of Dasyurus hallucatus*.

By OLDFIELD THOMAS.

AMONG the specimens obtained during Capt. Wilkins's expedition to Australia are examples of dasyures of the *D. hallucatus* group from Cape York, Groote Eylandt, King River (N.T.), and Torrens Creek, Queensland.

Comparing these with the considerable material already in the Museum collection, I find that there would appear to be at least four definable forms of this group, which may be diagnosed as follows:—

*Dasyurus hallucatus hallucatus*, Gould.

Size fairly large. General colour of medium intensity. Tail long, of medium bushiness, its terminal half above blackish brown, the proximal half drabby. Skull with the nasals comparatively little expanded behind, their posterior breadth rarely exceeding 9 mm.

*Range*. Northern Territory into Middle Queensland. Specimens seen from Port Essington, S. Alligator River, King River, and Alexandra, Northern Territory; and Torrens Creek and Inkerman, Queensland.

*Dasyurus hallucatus predator*, subsp. n.

Size rather larger. Ground-colour darker. Tail long, more bushy, and very dark brown or black for its terminal three-fourths, only the base being drabby. Skull with the nasals more expanded behind, their posterior breadth often attaining 12 mm.

Dimensions of the type:—

Head and body 308 mm.; tail 232; hind foot 48·5.

Skull: condylo-basal length 68·5; greatest breadth 41·5; nasals 24 × 11. The largest skull seen is 72 mm. in condylo-basal length.

*Range.* Cape York Peninsula. Specimens seen from Cooktown, Anman River, Piara, and Utingu.

*Type.* Adult male from Utingu. B.M. no. 15. 3. 5. 77. Original number 2394. Collected 26th June, 1912, by Robin Kemp.

The finest of the group; readily distinguishable by its comparatively bushy black tail.

Ramsay's *Dasyurus gracilis* (Proc. Linn. Soc. N.S.W. (2) iii. p. 1296, 1888) is clearly not this species, as it is said to have a dark brown under surface and white spots on the tail.

*Dasyurus hallucatus exilis*, Thos.\*.

Size smaller. Ground-colour very pale. Tail with but little terminal dark colour, this being also brown, not black. Skull small, with broadly expanded zygomata and narrow nasals. Further particulars in original description.

The first specimen of the *hallucatus* group that ever came to Europe was one of this subspecies obtained by Sir George Grey in 1838, probably at Hanover Bay, N.W. Australia. The type (B.M. no. 9. 4. 23. 8) came from Parry's Creek, E. Kimberley.

*Dasyurus hallucatus nescæus*, subsp. n.

Size small. Colour dark, but the sides pale, more strongly contrasted than usual. Crown dark, with white spots between ears. Muzzle, fore limbs, hind feet, and sides of neck drabby. Under surface drabby whitish. Tail decidedly shorter than in other forms, both actually and proportionately; comparatively short-haired, not bushy; its basal three-fifths above drab, the end above and whole under surface black.

Skull small, comparatively narrow, the zygoma not very widely expanded. Nasals narrow, but little expanded posteriorly. Postorbital projections little salient. Bullæ of medium size. Teeth proportionally rather large.

Dimensions of the type:—

Head and body 260 mm.; tail 211; hind foot 45.

Skull: greatest length from occipital crest 61; zygomatic breadth 35; nasals  $22 \times 9$ ; combined lengths of *ms.*<sup>1-3</sup> 13.

*Type.* Adult male. B.M. no. 26. 3. 11. 125. Original number 717. Collected 7th March, 1925, by Capt. G. H. Wilkins. Three specimens.

The short non-bushy tail and small size will readily distinguish this insular race from any of its allies.

\* Ann. & Mag. Nat. Hist. (8) iii. p. 152 (1909).

LXVIII.—*Brief Descriptions of new Thysanoptera*.—XVI.

By RICHARD S. BAGNALL, F.R.S.E., F.L.S.

THIS part, continued from Ann. & Mag. Nat. Hist. ser. 9, xviii. pp. 98–114, July 1926, contains descriptions of the following new species, etc. :—

- Thrips herricki*, sp. n.  
*Haplothrips* (*Trybomiella*, subgen. nov.) *articulosus*, sp. n.  
*Priesneria kellyana*, gen. et sp. n.  
*Trichaplothrips breviceps*, sp. n.  
*Eurhynchothrips flavicornis*, sp. n.  
*Eucænothrips*, nom. nov. for *Cænothrips*, Bagn.  
*Isopterothrips tenuipennis*, gen. et sp. n.  
*Dicaiothrips priesneri*, nom. nov.  
*Elaphrothrips brachyurus*, sp. n.  
*Actinothrips hargreavesi*, sp. n.  
*Anuctinothrips longisetis*, sp. n.  
*Bactridothrips laingi*, sp. n.  
*Gigantothrips turneri*, sp. n.  
 — *marshalli*, sp. n.

Of these *Trichaplothrips breviceps* is reported as carnivorous on a Psocid, whilst *Eurhynchothrips flavicornis* is apparently a gall-causer. In the following pages, apart from other records, I am able to give Australian records of the Holarctic species, *Limothrips cerealium* and *L. angulicornis*, and to deal with the synonymy of *Gynaikothrips ebneri* and *G. willcocksii* which are identified with galls on *Acacia arabica*. Many of the following species are large, important, and interesting, and I am particularly pleased to dedicate some of them to the following well-known entomologists:—The late Dr. F. Trybom, the well-known Swedish Thysanopterist; Dr. Heinrich Priesner of Austria, Prof. Glen W. Herrick of Ithaca, U.S.A., Reginald Kelly of Melbourne, Victoria, Dr. Guy A. K. Marshall, C.M.G., F.R.S., Director of the Imperial Bureau of Entomology, Frederick Laing of the British Museum of Natural History, E. Hargreaves, and R. E. Turner, Corresponding with the Imperial Bureau of Entomology and the British Museum of Natural History from West Africa and South Africa respectively.

## Superfamily THRIPOIDEA.

## Family Thripidæ.

*Thrips herricki*, sp. n.

♀.—Length about 1·3 mm., breadth of abdomen 0·38 mm.  
 Abdomen of a uniform dark brown, head and thorax

yellowish with the pronotum inclined to be darker, more or less diffused with grey-brown; femora brown, tibiae and tarsi yellow, the former lightly shaded with grey-brown basally. Fore-wings uniformly fumate.

Antenna 2-3 times as long as the head, joints 1 and 2 concolorous with head, 2 distally yellowish, 3 yellow shaded with grey, 4 brown with distal fourth pale, practically colourless, 5 to 7 dark grey-brown, with basal eighth of 5 pale and of 6 lighter.

Head transverse, cheeks swollen behind eyes, which are moderately coarsely faceted and pilose. Eyes about 0.44 the dorsal length of head, black; ocelli with deep crimson to maroon hypodermal pigmentation; each posterior ocellus separated from the inner margin of the eye by about 0.5 the breadth of the ocellus; inter-ocellar bristles situated on each side of the anterior ocellus, slender, and about 30  $\mu$  long, and a bristle behind each posterior ocellus (being the inmost pair of post-ocular series) almost as long. Dorsal surface behind eyes with transverse anastomosing lines.

Maxillary palpi 3-jointed, length of joints 19, 12, and 18  $\mu$  respectively.

Pronotum transverse, not much longer than head, postero-angular bristles long, the inner pair 0.7 the median length of head. Wings short, much as in *T. robustus*, Pr. Costa, distal part of upper vein, and lower vein of the fore-wing with 20-26, 1+2, and 8-13 setae respectively.

Fringe of eighth abdominal segment sparse.

Length (and breadth) of head 130 (180), pronotum 143 (214); length of pronotal bristles, outer postero-angular 90, inner ditto 102, inmost postero-marginal 36 to 40  $\mu$ . Length (and breadth near middle) of fore-wing 850 (52)  $\mu$ . Length (and breadth) of femora and tibiae, i. 150 (67): 135 (47); ii. 160 (45): 135 (40); and iii. 200 (54): 190 (40)  $\mu$ .

Relative lengths (and breadths) of antennal segments 2-7 approximately 43 (31): 62 (23): 60 (20): 58 (19): 62 (19) and 21 (8)  $\mu$ .

Lengths of abdominal bristles on segments 9 and 10, 160 and 150  $\mu$  respectively.

*Hab.* N. AMERICA, Ithaca, N.Y., ♀ ♀ only on *Veratrum viride*, 27. vi. 24 (Glen W. Herrick).

This species belongs to an essentially alpine group which I shall have the opportunity of discussing in detail shortly.

*Limothrips angulicornis*, Jabl.

*Hab.* AUSTRALIA, Watt's R., 4. iv. 18, 1 ♂ on *Polygonum*

(*R. Kelly*). Previously known from England, Hungary, Sardinia, Armenia, Transcaucasia, and North America, and taken by myself recently in France and Spain.

*Limothrips cerealium*, Hal.

*Hab.* AUSTRALIA, Sydenham, 20 miles south-west of Melbourne, both sexes plentiful on wheat, 25. xi. 15 (*R. Kelly*). S. AMERICA, Chiacaman, Vera Paz (*G. C. Champion*). Previously known from Europe, North America, Egypt, Africa, Seychelles, Hawaii.

Superfamily **PHLÆOTHRIPOIDEA.**

Family *Phlæothripidæ*.

*Haplothrips victoriensis*, Bagn.

In my original diagnosis of this species in Part IX. (*Ann. & Mag. Nat. Hist.* ser. 9, i. p. 208) there is a regrettable slip in the description of the antennal coloration. The statement "basal antennal segments yellow, very lightly touched with grey-brown" should read "basal antennal segments dark blackish-brown, joint 3 yellow, very lightly touched with grey-brown." Of later-described Australian species *H. froggatti*, Hood, comes nearest to this species; it is apparently smaller with a shorter third antennal joint and clear fore-wings except at base, whilst the pronotal setæ would appear to be shorter. The sub-basal bristles of the fore-wing are all brown in *H. froggatti*, in *H. victoriensis* the third is pale yellow and noticeably longer and more slender than the others, whilst the tube is 0·8 as long as the head compared to 0·7 the length in *H. froggatti*.

The following are further records:—

AUSTRALIA, Victoria, Healesville, on *Prunella vulgaris*, 18. i. 25, and on *Acacia* sp., in Queen's Park, 18. ii. 26; Kerang, *ex hortus* on roses, 4. iv. 26; Melbourne, on flower of *Sophora japonica* (from China) in the Treasury Gardens; Cohuna, on *Schinus molle*, 3. iv. 26; Warburton, on *Myrsine variabilis*, 17. i. 26 (*R. Kelly*).

*Haplothrips robustus*, Bagn.

A careful comparison with description of *H. varius*, Hood, shows that his species is almost identical with *robustus*. The chief difference lies in the lengths of the antennal joints, 4 and 5 of which are subequal (51:50) in *varius*, whilst in *robustus* 5 is markedly shorter than 4 (55:48  $\mu$ ). Another point of difference lies in the disposition of the

three sub-basal bristles of the fore-wing; in both cases they form a triangle, but in *varius* it is described as "an almost equilateral triangle," whereas in *robustus* (and also in the allied *melanoceratus*, Bagn.) the outer bristles form a base much greater in length than the sides of the triangle, the sides being sub-equal in *melanoceratus*, but unequal in *robustus*.

Should *H. robustus* from S. Australia and *H. varius* from N. Queensland prove to be forms of one species then the name *robustus* will have priority, the dates of publication being *robustus*, Bagnall, March 1, 1918, and *varius*, Hood, Dec. 19, 1918.

*Haplothrips gowdeyi*, Franklin.

*Haplothrips soror*, Schm., and *H. mahensis*, Bagn., are almost certainly synonyms of this cosmopolitan species.

*Hab.* FIJI, Lautuka, ♀ ♀ in flowers of *Tridax procumbens*, 6. i. 1926 (*W. Greenwood*), I.B.E., 298. BRAZIL, Rio Nictheroy, 1. viii. 1923 (per *J. Omer-Cooper*). INDIA, Almora, alt. 5,500 ft., Kumaon (*C. Paiva*), 4. vii. 1911, swept from jungle-plant, Ind. Mus., 4295/20; Calcutta, 16. xi. 1910 (*C. Paiva*), "biting the hand," Ind. Mus. 4291/20.

*Haplothrips (Trybomiella, m.) articulosus*, sp. n.

The subgenus *Trybomiella*, nov., with *Haplothrips bagnalli*, Tryb., as type, forms a natural group characterized by the structure of the third antennal joint and the absence of duplicated cilia in the fore-wings; the ♀ has the fore-tarsus armed with a minute tooth. Both *H. nigricornis*, Bagn., and *H. unicolor*, Bagn., belong here.

*H. articulosus* has the antennal joints 3-5 yellowish and 6 of a lighter brown than the following, thus closely approximating *H. bagnalli*, var. *pallicornis*, Tryb., but differing strongly from the known forms in the short third antennal joint.

♀.—Length 1.9-2.0 mm. Length (and breadth) of head and pronotum 202 (195) and 135 (310)  $\mu$  respectively. Length of wing 850  $\mu$ , of hind tibia 175  $\mu$ , and of abdominal segment 9, 90  $\mu$ . Length of tube 135  $\mu$ , width at base and apex 70 and 37  $\mu$  respectively.

Relative lengths (and breadths) of antennal segments 3-8 approximately as follows:—

*H. articulosus*, sp. n.:

43 (30) : 51 (33) : 48 (28) : 45 (26) : 39 (19) : 27 (12)  $\mu$ .

*H. bagnalli*, Tryb.:

45 (28) : 48 (34) : 45 (28) : 45 (28) : 40 (20) : 28 (11)  $\mu$ .

I believe that if a large amount of material from different plants be examined carefully satisfactory specific characters may be secured for several species of the complex just as Priesner's close researches in the European species have yielded rich results. Meantime, I can only deal with the material before me with diffidence.

Type in the British Museum of Natural History.

*Hab.* E. AFRICA, Tanganyika Territory; Morogoro, 9. i. 1925, both sexes from sunflower blossom (*A. H. Ritchie*), I.B.E. 197. Also represented in the Alluand and Jeannel collection.

#### Genus PRIESNERIA, nov.

Near *Haplothrips*. Head longer than broad and longer than pronotum. Antenna 8-jointed, joint 2 considerably constricted basally, median line outwardly curved; 3 shorter than either 2 or 4 with basal margin thickened and basal angles almost dentiform; 6 shorter than 5 or 7, and 7 and 8 closely united. Legs short, all femora broad. Wings fully developed, but not available for study. Body rather heavy, more as in *Trichothrips*.

The genus is chiefly remarkable for the structure of the antennal joints 2 and 3 and the long joint 7 as compared to 6.

Type. *Priesneria kellyana*, mihi.

#### *Priesneria kellyana*, sp. n.

♀.—Length about 1.25 mm.

Brown to grey-brown, all tibiae and tarsi yellowish, the tibia shaded with light greyish-brown on their outer margins. Antennal joint 3 and apex of 2 yellowish, lighter than the rest of antenna. Wings (from the remnant of an upper wing) apparently lightly fumate and sparsely ciliate. Antenna as described above, relative lengths (and breadths) of segments 2–8 approximately:

48 (30) : 37 (24) : 52 (27) : 46 (24) : 41 (20) : 46 (22) :  
24 (13.5)  $\mu$ .

Length (and breadth) of head, pronotum, and pterothorax 172 (150), 121 (243), and 284 (284)  $\mu$  respectively. Length (and breadth) of femora and tibia, i., 148 (68) : 108 (36); ii., 108 (54) : 94 (34); iii., 162 (74) : 148 (34)  $\mu$ . Width of abdomen near middle 310  $\mu$ ; length of tube 98  $\mu$  and width at base and near apex 65 and 32  $\mu$  respectively.

Type in coll. Bagnall.



R. S. Bagnall on new *Thysanoptera*.

*Hab.* AUSTRALIA, Melbourne, Victoria, 10. iii. 1925,  
"alighted on my newspaper on Melbourne Cricket Ground"  
(R. Kelly).

*Trichaplothrips breviceps*, sp. n.

The unique example of this distinct species is unfortunately mutilated; joints 6-8 of both antennæ and all the legs excepting the left fore-leg are missing.

♂.—Length about 1.4 mm.

Brown, fore-tibia yellow; basal antennal joint brown, 2 yellowish distally, 3 yellowish, and 4 and 5 light grey-brown. Wings lightly fumate.

Head transverse, darker than the pronotum, the eyes occupying about 0.5 the length and space between them wider than the length of an eye; post-ocular bristles very long and slender. Antennal joints 3 and 4 claviform, angulate at distal third or thereabouts.

Pronotal bristles similarly long, slender and colourless, blunt; mid-lateral pair (placed immediately below the antero-angular pair) as long as the outer postero-angular and longer than the median length of the pronotum. Wings closely ciliate, sub-basal bristles of fore-wing arranged in a more or less straight line; duplicated cilia absent.

Abdomen with intermediate segments strongly transverse; tube short; abdominal bristles long, slender, and colourless, those on segment 9 and the terminal hairs markedly longer than the tube.

Length (and breadth) of head and pronotum 152 (194) and 100 (275)  $\mu$  respectively; length of post-ocular, outer antero-marginal, mid-lateral (placed just below the last-named), and outer postero-angular pronotal setæ 95, 63, 110, and 110  $\mu$  respectively. Length of wings 620  $\mu$ . Length of tube 100, width at base 65 and at apex 38  $\mu$ . Relative lengths (and breadths) of antennal joints 2-5 approximately 44 (27) : 52 (32) : 49 (30) : 45 (27)  $\mu$  respectively.

Type in Coll. Bagnall.

*Hab.* CEYLON, Peradenyia, 1 ♂ noted to be carnivorous on Psocid (*Archipsocus*), xii. 1911 (Fryer).

*Eurhynchothrips flavicornis*, sp. n.

♀.—Length about 1.6 mm.

Head, pronotum, and pteronotum laterally dark brown, rest of body not quite so dark except tube, which is very dark in the basal two-thirds or thereabouts. Antenna with basal joint brown, 2 light yellowish-brown distally, 3-8

pale lemon-yellow. All coxæ and femora brown, fore-tibiæ and all tarsi pale lemon-yellow, hind and intermediate tibiæ yellowish-brown. Wings pale.

Head widening posteriorly, 0·7 as long as wide at base, eyes short and broad, the posterior ocelli close to inner margins of eyes and the anterior one forwardly directed. Post-ocular bristles colourless, blunt, 1·3 times as long as the length of eye. Mouth-cone massive, medianly practically as long as the dorsal length of head. Antenna more than twice the length of head, joint 2 broad at base with the sides practically sub-parallel; 3 obconical or broadly clavate, 4 shorter and broader basally than 3, and 6 shorter than 5 or 7.

Pronotum massive and strongly transverse, about 0·7 the length of the head and 2·8 times as broad as long; bristles colourless, straight, and blunt, those at posterior angles about 0·75 the median length of pronotum and the antero-marginal and mid-lateral well developed, being from 0·36 to 0·45 the length of the postero-angular. Legs rather stout. Forewings with 8–10 duplicated cilia.

Lateral abdominal bristles colourless, blunt, long, those on segment 9 longer than the tube; terminal hairs fragile, about 0·85 the length of the tube.

Length of head 185, breadth across eyes 190 and at base 256  $\mu$ . Relative lengths (and breadths) of antennal joints approximately: 38 (43): 51 (34): 65 (36): 46 (38): 49 (35): 32·5 (34)  $\mu$  respectively. Length (and breadth) of pronotum and pterothorax 135 (378) and 418 (460) and breadth of abdomen 472  $\mu$ . Length of tube 162 and breadth near base 18 and at apex about 45  $\mu$ .

♂.—Much as in the ♀; emargination at base of tube very deep.

Type in the British Museum of Natural History.

*Hab.* W. AFRICA, Sierra Leone, Falabe, 6. ii. 1925, both sexes from stem-gall of *Mitrageyne macrophylla* (*E. Hargreaves*, No. 168), I.B.E. 185.

This species is readily separated from *E. convergens*, Bagn. (also a West African species), by the divergent instead of convergent head, the broader pronotum, the entirely pale antennal joints 3 to 8, the longer second and fourth to sixth antennal joints, etc.

*Gynaikothrips ebneri*, Karny, and *G. willcocksii*, Bagn.

Early in 1925 Mr. H. B. Johnston submitted a number of *Gynaikothrips*, found on *Acacia arabica* at Khartoum,

## Bagnall on new *Thysanoptera*.

29. i. 1925, to the British Museum, and comprising the two species I described as *G. obscuripes* and *G. willcocksii* respectively (Ann. & Mag. Nat. Hist. ser. 9, vii. pp. 362, 365, pl. ix.). In a note to this citation I suggested that *G. ebneri*—the description of which I had not seen until the final proofs had been passed—might prove to be very closely allied to, if not identical with, *G. obscuripes*. Since then both Karny and Priesner have redescribed *G. willcocksii*, whilst I have dismounted and dissected the type-specimen so as to compare the wings. The following is the synonymy of the two species:—

### *Gynaikothrips ebneri*, Karny.

*Gynaikothrips ebneri*, Karny, 1920, Akad. Anz. ii., Wien; 1921, Denkschr. Akad. Wiss. Wien, Math.-nat. Kl. xcvi. p. 19 (sep.), figs. 12–23.

*Gynaikothrips obscuripes*, Bagnall, 1921, Ann. & Mag. Nat. Hist. ser. 9, vii. p. 362, pl. ix.

### *Gynaikothrips willcocksii*, Bagn.

*Gynaikothrips willcocksii*, Bagnall, 1921, Ann. & Mag. Nat. Hist. ser. 9, vii. p. 364; *G. wilhami*, Karny, 1923, Bull. Soc. Roy. Ent. d'Egypte, Année 1922. p. 128; *Liophlæothrips* (?) *acaciæ*, Priesner, 1923, Entom. Mitteilungen, xii. p. 117.

*G. willcocksii* may be separated from *G. ebneri* by the coloration of the antennæ and by the clear hyaline forewings, which are furnished with a series of 12–14 duplicated cilia (about 16, according to Karny).

### *Liothrips nigricornis*, Bagn.

Karny has recently suggested the subgeneric name *Ethirothrips* (Bull. Ent. Res. xvi. p. 133, Oct. 1925) for the species *Liothrips nigricornis*, Bagn., *L. thomasseti*, Bagn., and *L. intrepidus*, Bagn., to which I gave a key in 1921 (Ann. & Mag. Nat. Hist. ser. 9, vii. p. 289). I consider that this group justifies generic rank, but a study of the species described by Schmutz in his genus *Ischyrothrips*—two at least belonging to or near this *Liothrips* group—would be necessary before deciding upon the generic name. The type of *Ischyrothrips* should be *I. obscurus*, Schm., that being the species first described.

*Hab.* PAPUA, Goodenough Is., D'Entrecasteaux Group, ex cotton, 5. ix. 1925 (*E. Ballard*), I.B.E. 278. Previously known from the Seychelles (*Silhouette*). I also have what appears to be this species from Ceylon.

My original records are apparently referable to ♀ ♀; the ♂ has the anterior femur more elongated than in the ♀ and the tibiæ curved.

Genus *EUCENOTHRIPS*, nom. nov.

for *Cænothrips*, Bagnall, 1924, nec *Cænothrips*, Hood, 1916.

Hood (*in lit.*) points out that he used the name *Cænothrips* in 1916, so that a new name is necessary for my *Cænothrips*—a name that seemed familiar to me when I proposed it.

As a matter of fact, *Cænothrips* was proposed by Hood as a subgenus of *Oxythrips* to include *firmus*, Uz., and *ericæ*, Hal., and is therefore in turn invalidated by my genus *Amblythrips*, 1911.

*Trichothrips melanurus*, Bagn.

I recorded the unique specimen as follows:—"AUSTRALIA, F. T. Gulley, 27.10.13, F. Spry." Mr. Kelly is able to throw further light on this specimen, and states that the locality should read: "Fern Tree Gully" (a township and district 22 miles east of Melbourne), a wooded and hilly country. The slide was handed to Kelly by the late F. Spry, with the information that it was found under the damp rotting bark of a dead and fallen *Eucalyptus* trunk.

Genus *ISOPTEROTHRIPS*, nov.

Belonging to the *Macrothrips* group.

♀.—Size moderate, form linear. Head a little longer than broad. Antennæ about 2.0 times the length of head, intermediate joints not long; joint 3 only a little more than 2.0 times as long as broad near apex. Post-ocular bristles very long. Mouth-cone reaching across prosternum, blunt.

Pronotum transverse, shorter than head, simple. Fore-legs, enlarged, tibiæ rather short, stout, fore-tarsus armed with a long stout tooth; fore-femur and tibia simple. Wings fragile, long, very narrow, and margins subparallel; cilia not very close, fore-wing with a series of duplicated cilia. Abdomen linear, tube longer than the head.

Type. *Isopterothrips tenuipennis*, m.

S. Bagnall on new *Thysanoptera*.

*Dicaiothrips tenuipennis*, sp. n.

♀.—Length about 3·0 mm.

Dark blackish-brown, fore-tibiæ and tarsi lighter; antenna with joints 1 and 2 blackish-brown, 2 lighter distally, 3 yellowish brown to brown in distal half; 4–6 dark blackish-brown inclined to be lighter at extreme distal end, and 7 and 8 not so dark.

Head 1·2 times as long as broad and 1·5 times as long as pronotum; genal spines few; eye about 0·25 the length of head; ocelli large, the anterior one forwardly directed; each of the posterior pair contiguous to the inner margin of the eye; post-ocular bristles long and slender, twice as long as the eye and set close to their posterior margins. Relative lengths (and breadths) of antennal joints approximately:—

57 : 76 : 103 (43) : 89 (41) : 86 (38) : 84 (35) : 62 (24)  
and 49 (11)  $\mu$ .

Pronotum strongly transverse, slightly more than twice as broad as long; bristles pale, those at hind angles about 0·7 the median length of pronotum; bristle on fore-coxa small, not prominent. Wings very narrow, colourless, about 18 times as long as broad, apparently not constricted near middle, but reminiscent of the *Haplothrips* type.

Abdomen scarcely broader than the pterothorax, subparallel to segment 7; tube heavy, 1·2 times as long as the head, gradually narrowing towards apex, where it is sharply but not deeply constricted. Terminal hairs colourless, weak and about 0·7 the length of the tube; abdominal bristles also colourless and weak, those on 9 about 0·8 the length of the tube.

Type in the British Museum of Natural History.

*Hab.* W. AFRICA, Aburi, Gold Coast, 3. xii. 1915 (*W. H. Patterson*), 1 ♀ from Shot-hole, borers' tunnels in dead stem of *Loranthus* on *Hevea*, Reg. 271, I.B.E. 105.

Family Idolothripidæ.

*Dicaiothrips priesneri*, nom. nov.

*Dicaiothrips breviceps*, Priesner, Oct. 1, 1921 (nec Bagnall, Oct. 1, 1921).

The name *breviceps* was used by both Priesner and myself for different species in papers published on the same date, so

that a new name, here proposed, becomes necessary for one of them!

*Elaphrothrips brachyurus*, sp. n.

♀.—Length 3·6 mm.

Dark blackish-brown; fore-tibiæ yellowish-brown, except basally and along the inner and outer margins, fore-tarsi also yellowish-brown, marked with dark grey-brown and distal segment dark grey-brown. Antenna with joint 2 lighter distally, 3 yellowish with apex shaded with brown to grey-brown; 4 with basal 0·45 yellow and 5 with basal 0·3 light yellowish-brown. Wings clear.

Length of head 608, of eye 135, and of produced part at outer and inner insertion of antennæ respectively 40 and  $67\mu$ ; width across head near base, behind eyes, and across eyes 284, 230, and  $210\mu$  respectively. Length (and breadth) of pronotum, pterothorax, and eighth abdominal segment 202 (405), 608 (526), and  $298\ (270)\mu$  respectively; greatest breadth of abdomen c.  $500\mu$ . Length, breadth at base and breadth at apex of tube 338, 150, and  $68\mu$  respectively, terminal hairs as long as and bristles on abdominal segment 9 1·2 times as long as tube. Length (and breadth near middle) of fore-wings 1485 ( $108\mu$ ); length (and breadth) of femur and tibia i., 405 (148):365 (68), ii., 350 (95):350 (62), and iii., 486 (98):486 (54) $\mu$ . Relative lengths of antennal joints 3–8 approximately 165:156:142:101:64 and  $61\mu$ .

Antero-ocular setæ dark, over-reaching first antennal joint; post-ocular pair placed well back, short.

Type in the British Museum of Natural History.

*Hab.* S. AFRICA, Port St. John, Pondoland, April 1923, 1 ♀ (*R. E. Turner*), B.M. 1923.286.

*Actinothrips hargreavesi*, sp. n.

♀.—Length about 5·5 mm.

Dark blackish-brown, end of all tibiæ and all tarsi yellowish-brown; antennal joint 3 pale yellowish-brown, darker near apex, 4 brown, darker apically, 5 to 8 broken off but presumably of a uniform dark brown. Wings very lightly fumate, median vein (which is strong for about 0·6 the length of the wing) brown.

Head much as figured for *A. longicornis*, Bagn., but longer

and only slightly produced beyond the eyes; cheeks with two prominent pairs of colourless genal spines as in *longicornis*; post-ocular bristles, if present, impossible to discern, and the strong basal spine of the basal antennal joint characteristic of *longicornis*, apparently absent. Outer postero-angular bristles of the pronotum long ( $162\ \mu$ ), the inner pair only 0.6 as long and weaker. All pronotal, femoral, and abdominal bristles colourless, blunt. Tibiæ and tube (especially in the basal two-thirds or thereabouts) strongly setose, those on tube 0.6 to 0.7 as long as the width of tube near middle. Legs long, fore-femur with the outer basal angle produced. Fore wing with a long series of duplicated cilia.

This species is smaller than *longicornis*, with a longer head from anterior margin of eyes to base and a shorter produced part; with differently coloured antennæ, shorter tube, and the wing-veins only continued to beyond the basal half.

Length of head to a line across anterior margins of eyes 567, of produced part 27, and width at broadest part before base, behind eyes, and across eyes 274, 256, and  $297\ \mu$  respectively. Length of antennal joints 3 and 4 (the rest missing) 418 and  $337\ \mu$  respectively. Length (and breadth) of fore-femur 580 ( $148\ \mu$ ). Length of tube 1080, breadth at broadest part (near basal sixth or thereabouts) 162, near middle 135, and at apical constriction  $81\ \mu$ .

Type in the British Museum of Natural History.

*Hab.* W. AFRICA, Sierra Leone, Njala, 23. v. 26 (*E. Hargreaves*), I.B.E. 326.

*Anactinothrips longisetis*, sp. n.

Length about 5.0 mm.\*.

Colour much as in *A. distinguendus*, Bagn. Antenna with joint 3 pale, 4 yellow tinged with greyish-brown, 5 light brown, and 6-8 brown.

Head slightly produced beyond eyes, slightly more than 2.5 times as long as the pronotum, and 1.8 times as long as broad near base; genal spines stout and much shorter than in *distinguendus*. Dorsal bristles long, as long as the greatest breadth of the head and somewhat longer than the post-oculars; inter-ocular pair short and stout reaching to

\* The length of *A. distinguendus*, Bagn., is given as 7.5 mm. instead of c. 6.5 mm.

beyond the seat of antennæ. Antenna much as in *distinguendus*, length of intermediate joints 3-6 in the known species as follows:—

<i>A. longisetis</i> , sp. n.	431 : 297 : 216 : 162 $\mu$ .
<i>A. meinerti</i> , Bagn.	648 : 390 : 189 : 148 $\mu$ .
<i>A. distinguendus</i> , Bagn.	621 : 378 : 297 : 162 $\mu$ .

Pronotum with the anterior margin strongly emarginate, bristles at anterior angles and the mid-lateral pair stout, about 0.26 and 0.4 the median length of pronotum respectively and those at posterior angles about 0.9 the median length. Fore-wing with all cilia closely set and a duplicated series of over 40. Tube about 0.9 the length of the head, 3.5 times as long as broad at base, where it is 2.5 times as broad as at extreme apex. Lateral abdominal bristles on segments 4-7 long and stout, the longest on 5-7 as long as or longer than the tube, whilst those on 9 are about 1.4 times the length of the tube. Terminal hairs broken in the unique example.

This species is distinguished from both *meinerti* and *distinguendus* by its smaller size and the short third antennal joint, and from the latter by the form and chætotaxy of the head, which in *distinguendus*, is scarcely produced beyond the eyes and has the genal spines long and the dorsal bristles weak. *A. meinerti* differs from both *longisetis* and *distinguendus* in its long head and tube and in the short antennal joint 5 as compared to 3 and 4.

Type in the British Museum of Natural History.

*Hab.* S. AMERICA, British Guiana, Cattle Trail Survey, vi. 1919, I.B.E.

## GENUS BACTRIDOTHRIPS, Karny.

### Table of Species.

1. Size larger, 7.0 mm., tube approximately 2.0 times as long as the head. Species Oriental ..... 2.
- Size smaller, c. 5.0 mm., tube only 1.5 times as long as the head. Species W. African ..... *B. laingi*, sp. n.
2. The ♂ with horns of abdominal segment 6 longer, armature of segment 8 weaker; tube less strongly setose in the basal half. Legs longer. Perak. .... *B. idiomorphus*, Karny.
- The ♂ with horns of abdominal segment



6 shorter, armature of segment 8 longer and stronger; tube strongly setose except in the distal fifth. Legs shorter. Ceylon. *B. serraticornis*, Bagn.

*Bactridothrips laingi*, sp. n.

Length about 5.0 mm.

Dark blackish-brown, ends of the tibiae and tarsi lighter, inclined to yellowish-brown. Antennae brown, joint 3 yellowish lightly shaded with grey, 4 light yellowish-brown. Wings shaded lightly with grey, heavy median vein in both pairs running to beyond middle.

Head about 2.25 times as long as broad in the basal third, where it is broadest; eyes about 0.25 the dorsal length of the head; a pair of strong colourless genal spines behind eye and a second pair at basal third; post-ocular bristles short; a post-ocellar pair about as long as or somewhat longer than the diameter of an ocellus and inter-ocellar pair—one on each side of the anterior ocellus about 2.5 times the length of the diameter. Antenna about 2.5 times as long as the head. Length of antennal joints 3–8 in the known species approximately as follows:—

*B. laingi*, sp. n. 388 : 297 : 256 : 210 : 97 : 81  $\mu$ .

*B. idiomorphus*. 680 : 480 : 420 : 270 : 100 : ?  $\mu$ .

*B. serraticornis*. 570 : 412 : 350 : 250 : 96 : 85  $\mu$ .

Pronotum 2.0 times as broad as long and 0.4 as long as the head, bristles at hind angles colourless, slightly knobbed and about 0.5 the median length of the pronotum. Forewings with about 40 duplicated cilia. Horns of abdominal segment 6 straight, backwardly directed, sub-parallel, and not reaching the juncture of segments 7 and 8; 7 and 8 much as in *serraticornis*; tube about 1.5 times as long as the head, sparingly setose and more sparing distally, the setae being about 0.6 the width of the tube; terminal hairs weak, colourless, and about 0.3 the length of the tube.

Type in the British Museum of Natural History.

*Hab.* W. AFRICA, Sierra Leone, Taninahun, 1 ♂, February 1925 (*E. Hargreaves*), I.B.E. 191.

*Gigantothrips tibialis*, Bagn.

In looking over some Thysanoptera literature I was struck by the figure illustrating the end of the abdomen of Karny's

*Idolothrips schenklingi* (Entom. Mitteilungen, ix. pp. 189–191, Dec. 1920), and upon going closely into the accompanying description I can only refer his species to the genus *Gigantothrips*, in which case my *G. tibialis* may prove to be the same species. Should this prove to be so, then Karny's name will have priority.

*Gigantothrips turneri*, sp. n.

♂.—Length about 7·0 mm.

Colour chestnut-brown; wings, especially the fore-wings, lightly tinged with grey-brown. Antenna with joint 1 concolorous with head, 2 paler apically, and 7 and 8 of a uniform grey-brown; 3 and 4 yellowish, grey-brown near apices, and 5 and 6 basally yellowish shading to grey-brown distally.

Head to a line across the anterior margin of eyes a little more than 1·8 times as long as broad near base where it is broadest; vertex not produced; post-ocular bristles apparently vestigial, genal setæ minute. Antennæ somewhat stout for the genus, about 1·6 times the length of the head.

Pronotal bristles apparently vestigial excepting postero-angular and marginal pairs, which are short and very stout. Legs rather stout. Wings long and broad, cilia close with 35–40 duplicated in the fore-wing.

Abdomen long, slender, with spines at hind angles of segments 2–8 dark and very short and stout. Tube long and slender, nearly twice as long as the head and about 11·0 times as long as broad near middle; terminal hairs short, about 0·2 the length of the tube, pale.

Length of head 620, width across base 340, behind legs 250, and across eyes 280  $\mu$ . Width across fore-coxæ 540 and of pterothorax 770  $\mu$ . Length of tube 1150 and of abdominal segments 8 and 9 respectively 432 and 270  $\mu$ . Length (and breadth) of fore-wing 2025 (190)  $\mu$ . Relative lengths of antennal joints 3–8 approximately 324:189:150:108:67 and 50  $\mu$ .

♀. Larger and stouter with tooth of fore-tarsus longer and curved. Abdomen broader with spines longer and segment 9 also furnished with similar stout spines.

Type in the British Museum of Natural History.

*Hab.* S. AFRICA, Port St. John, Pondoland, May 1923 (*R. E. Turner*), B.M. no. 1923.307.

S. Bagnall on new *Thysanoptera*.

This species, in its unicolorous legs, comes near the South African *G. cunicularius* (Lugger), which, however, has the tube as long as the preceding five abdominal segments together and more than 2.5 times as long as the head. It is a larger species than *Cercothrips afer*, Pr., but recently described from the Egyptian Sudan, and differs also in the shorter antennæ, relative lengths of the antennal joints, the presence of duplicated cilia in the fore-wings, etc.

*Gigantothrips marshalli*, sp. n.

♀.—Length about 8.0 mm.

Colour dark brown, head somewhat lighter and tube markedly lighter; femora paler basally and distally, fore-tibiæ pale at base and shading to a pale yellow distally; intermediate and hind tibiæ pale yellowish-brown in the distal fourth and half respectively in one specimen, but more generally pale in the type-example; all tarsi yellowish.

Antenna with basal joint brown, concolorous with head, 2 pale yellowish-brown darker basally, 7 and 8 pale yellowish-brown; stem of 3 and basal half or thereabouts of 4 and 5 and basal third of 6 very pale, almost colourless, the swollen part very pale greyish-yellow, darkening in the more distal joints. Wings clear with cilia closely set, fumate; fore-wings with a long series of duplicated cilia. Abdominal spines inclined to become pale distally.

Apart from the coloration of tube, wings, legs, antennæ, and abdominal spines this species may be separated from *G. turneri*, sp. n., by the pronotal and abdominal spines and those on the femora which are much less strong; the tube is noticeably stouter, being but 9.0 times as long as broad near middle.

Length of head 648, width across base 338, behind eyes 256, and across eyes 318  $\mu$ . Width across fore-coxæ 688, and of pterothorax 1012  $\mu$ . Length of tube 1280  $\mu$ .

Length of antennal joints 3-8 approximately 364:216:190:158:94:68  $\mu$ ; joints 4 to 6 claviform, 7 and 8 closely united.

Type in the British Museum of Natural History.

*Hab.* W. AFRICA, S. Nigeria, Ibadan, 1926 (*O. B. Lean*, nos. 86 and 88), 2 ♀ ♀ only, I.B.E. 322-3.

LXIX.—*New and little-known Cyrtidæ (Diptera).*

By E. BRUNETTI.

THE material on which the present paper is founded has been drawn from various sources, as, in addition to descriptions of 29 new species, a number of the older authors' species have been available for study. Redescriptions or additional notes are offered of many of these. It has been my good fortune to have before me simultaneously a much larger proportion of types than is ordinarily the case—for instance, 7 types out of 10 species present in the difficult genus *Philopota*, 7 types out of 10 species of *Acrocera*, and no less than 19 types out of 24 species of the most intricate genus of the family, *Oncodes*, irrespective of two new varieties of the European *O. varius*, Latr.

Through the kindness of Prof. E. B. Poulton, of Oxford University Museum, I have been permitted to examine the types of four of Westwood's species in *Philopota*, and my thanks are also due to M. E. Seguy of the Paris Museum for looking up all the material in this family in their extensive collection, thus enabling me to add some interesting notes on several of Macquart's species as well as to set up six new ones, including one new genus. From Dr. J. Descheide, of the Belgian Congo Museum, I received for description one new species and one new variety; and the descriptions (drawn up several years ago) are added here of five new species in the Indian Museum. A considerable number of new forms have come to light in the small collections sent to the Imperial Bureau of Entomology, and the types of these have been presented to the British Museum by this Institution.

Subfamily *PHILOPOTINÆ*.*Table of Species of Philopota* \*.

- |   |                          |
|---|--------------------------|
| 1. Scutellum with very distinct, clearly-cut yellow margin  | 2.                       |
| Scutellar margin without trace of yellow  | 3.                       |
| 2. Front margin of prothoracic plates wholly broadly yellow: mesothoracic longitudinal stripes long and curved, ending on or near hind margin of dorsum, brownish yellow; wings uniformly yellowish: almost a yellowish-brown species | <i>sobria</i> , Walk.    |
| Front margin of prothoracic plates not wholly broadly yellow, but only the outer front corners broadly so; mesothoracic stripes short and straight, pale yellow: almost a chestnut-brown species                                      | <i>temperata</i> , Walk. |
| 3. Front or hind margins, or both, of prothoracic plates wholly yellow, the colour sometimes interrupted in median line   | 4.                       |

\* This table contains only species seen by me and actually present simultaneously at the time of writing. All were represented by types except *ænea*, Big., and *murina*, Lw.

- Front and hind margins of prothoracic plates wholly black or dark brown, at most the hinder angles extremely narrowly pale (in *flavolateralis*, anterior outer angles also) ..... 5.
- Abdomen robust; second, third, and fourth segments subequally wide; yellow colour along sides of tergites not extended also ..... *ovata*, Westw.
- Hind margins dorsally .....  
    Conical from base to tip, no two contiguous segments equally wide; yellow colour of extreme sides of tergites extended also along hind margin ..... surface of second segment and more broadly so on third, appearing almost as a pair of transverse spots ..... *liturata*, Westw.
5. Hinder part of mesonotum abnormally elevated, bearing two rather small tubercles; (hind angles of prothoracic plates narrowly brownish yellow). Mesonotum normally shaped, without tubercles, but approaching the form of *tuberculata* in *flavolateralis* ..... *tuberculata*, Westw.
6. Aeneous species ..... 6.  
Black (or dark red-brown) species, with yellow markings ..... 7.
7. Hinder part of centre of mesonotum slightly drawn out into two small tubercles (as in *tuberculata*, but to a less degree); frons bright red-orange except on extreme upper part. Wings distinctly darker brown down to fourth vein, the clear yellowish remaining part sharply delimited. Pubescence of abdomen conspicuous in profile, distinctly longer and less depressed, brownish yellow on basal segments, yellowish grey to whitish on remainder ..... *aenea*, Big.
- Mesonotum without trace of such tubercles; frons mainly black, but rather bright brown anteriorly. Wings uniformly pale yellowish. Abdominal pubescence barely visible in profile, bright yellow on basal segments, whitish on remainder ..... *viridænea*, Brun.
8. First abdominal segment with hind margin conspicuously though narrowly yellow ..... *flavolateralis*, sp. n.  
First abdominal segment all black ..... 9.
9. Anterior half of wing distinctly darker brown than remainder, but not sharply delimited; abdomen dull reddish brown; a minute brownish-yellow spot on hind angles of prothoracic plates, another just above it, a third over wing-base, and an elongate one on posterior calli. Tibiæ and tarsi considerably or mainly black. Long. 10 mm. .... *maculicollis*, Westw.
- Wings uniformly brownish yellow, barely paler hindwards. Abdomen black except the extreme sides and the tip, which are narrowly yellow; only thoracic yellow spot at hind angles of prothoracic plates. Tibiæ and tarsi whitish yellow. Long. 7 mm. .... *murina*, Lw.

*Philopota conica*, Wd.

I found five specimens, not in the best condition, in the Paris Museum, mostly not located, but one was from Rio de Janeiro.

*Philopota anea*, Big.

A specimen from North Pekin [*A. David*, 1865] (Paris Museum) is this species, and Mr. Hervé-Bazin very kindly gave me both sexes taken by him at Zi-ka-wei, in the neighbourhood of Shanghai. It seems confined to China and Japan.

*Philopota murina*, Lw.

One in British Museum from Manash, Amanus Mts., Asia Minor, May 1903.

*Philopota ovata*, Westw.

*Head.* Frons moderately prominent, chestnut-brown, tip bright yellow, whole frons with whitish hair; antennæ black; proboscis basally moderately dark brown, shining, remainder whitish yellow. Occiput dark reddish brown, finely punctate.

*Thorax* dark reddish brown, finely punctate; front and hind margins of prothoracic plates rather narrowly yellow, the width of the colour slightly varying in individuals, clear cut and uninterrupted, the inner and outer margins without traces of yellow. A rather narrow, slightly curved, yellow stripe towards each side of dorsum, the anterior ends broadly separated in the middle line, the stripes continuing uninterrupted over margins of hind corners of dorsum up to base of scutellum. A good-sized yellow spot on mesopleura and a smaller one on prothorax just above front coxa; scutellum unmarked.

*Abdomen* concolorous with thorax, similarly punctate; hind margin of first segment with clear-cut bright lemon-yellow band. Extreme side margins of abdomen narrowly yellow, the colour continuous, but never spread along hind margins of dorsum of second and third segments. Venter concolorous with dorsum. Pubescence of abdomen microscopic, pale yellowish.

*Legs.* Coxæ, trochanters, femora, and tarsi concolorous red-brown with body; tips of coxæ, tips of femora rather broadly, and base of first tarsal joint pale lemon-yellow. Tibiæ pale lemon-yellow except hinder side of fore pair, inner side of middle pair, and front side of hind pair concolorous red-brown. Pubescence of legs whitish.

*Wings* yellowish grey; rather dark brown on basal two-thirds, as far hindwards as fourth vein, the brown colour narrowing towards tip of wing and ending a little behind tip of third vein. Halteres lemon-yellow.

*Length* 8 mm.

The type in the Oxford Museum is in sufficiently good condition, and five specimens in the British Museum from Brazil, or without data, are conspecific. The type bears a label "Tapayó" as well as "Brazil."

*Philopota liturata*, Westw.

The type of this species, also at Oxford, is in good condition. *P. liturata* is very close to *ovata*, but possesses apparently three good characters. 1st, the yellow colour of the extreme side margins of the abdomen is extended along the hind margins of the second and third segments, narrowing gradually but not meeting in the middle line; 2nd, the abdomen is truly conical from the second (the widest) segment to the tip, every succeeding segment being very definitely narrower than its predecessor, whereas in *ovata* the second, third, and fourth segments are practically subequal in width, and the whole abdomen relatively broader; 3rd, the wings are uniformly yellowish grey. A minor character seems to be the more yellowish last tarsal joint.

Length 7 mm.

I found a second specimen amongst the short series of *ovata* in the British Museum. It had been labelled "? *ovata* var." by Col. Yerbury. When examined alongside of the type the two were found to agree in every particular. Westwood suggested that *liturata* might be the ♂ of *ovata*, and if the two forms should be conspecific the name *liturata* takes precedence by one page\*. The genitalia in all the specimens involved being too concealed or too dirty for observation, I am unable to offer any opinion as to sex.

*Philopota tuberculata*, Westw.

Westwood's type is at Oxford in quite recognizable condition owing to the peculiar specific character, but the head and part of the thorax are very dirty and covered with some gummy substance. Proboscis yellow (basal part unobservable). Hinder part of thoracic dorsum very elevated, rather squarish, and drawn out into two prominent bumps (exactly as described by Westwood), which tower almost above the post-alar calli, which themselves are more conspicuous than usual. Hind angles of prothoracic plates yellow-brown, also a spot on outer side of the typical thoracic bumps, with a smaller one below it placed on front margin of post-alar calli. Scutellum very shining black, prominent, its sides dull red, no trace of yellow on hind margin. Abdomen shining black, anterior corners broadly brownish yellow, the colour narrowing gradually and disappearing at tip of fourth segment. Pubescence of abdomen yellowish. Venter yellowish, with a little concolorous pubescence. Legs mainly pale yellow; coxæ, trochanters, and basal half of femora shining black. Wings uniformly yellowish brown down to fourth vein, remainder pale yellowish grey; squamæ rather bright ochraceous yellow with a little yellow pubescence; margin conspicuously dark brown, shining; halteres yellow.

Length 6 mm., apart from curvature of body.

\* Page 94, against 95.

The specimen is from the J. W. Miers collection. The conspicuous bumps on the elevated hinder (or almost middle) part of the mesothorax make this species distinct from all others.

*Philopota maculicollis*, Westw.

*Head.* Eyes contiguous for only half distance from vertex to base of antennæ, with very short, dense, black pubescence. Frontal triangle much larger than usual, nearly flush with eyes, red-brown with whitish-grey depressed hair, extreme tip pointed, pale yellow. Antennæ very minute, black, protected by the almost overhanging tip of the frons. Face short, black, with whitish pubescence; mouth-opening large, oblong; proboscis at base concolorous with frons, remainder whitish yellow, reaching to three-fourths length of body. Occiput red-brown, punctate, vertical tubercle small.

*Thorax* red-brown, mainly finely punctate, more coarsely so and wrinkled in parts. Small brownish or yellowish spots as follows:—On hind angles of prothoracic plates, an almost microscopic one behind each of them, a larger (though still small) triangular one above wing-base, and a very small transverse one on hind margin of posterior calli. Scutellum concolorous with thorax, similarly punctate.

*Abdomen* concolorous; apical region with yellowish depressed pubescence (viewed best from in front); extreme sides of abdomen narrowly lemon-yellow from third segment to tip. Venter as dorsum, side margins narrowly yellowish on basal segments.

*Legs* concolorous with body. Femora black, underside broadly reddish basally, tips rather narrowly yellow. Tibiæ black, narrowly yellowish at base; tarsi black, tips of joints yellowish. (Hind legs missing.)

*Wings* brownish yellow, darker anteriorly and in middle, but the colour not sharply delimited; squamæ obscurely whitish, with microscopic pale pubescence, margins conspicuously blackish brown. Halteres yellow, visible through squamæ.

*Length* 10 mm.

Brazil (*D. Swainson*).

The type, at Oxford Museum, is the only specimen I have seen. It is in fair condition, and the species is very distinct by the comparatively short length of contiguity of the eyes, the large frons, and by the uniformly reddish-brown body and its size.

*Philopota sobria*, Walk.

*Redescription.*—? ♂. *Head.* Eyes black, closely contiguous for one-third the distance from vertex to antennæ, with short, dense, dark brown pubescence; vertical triangle of medium size, rather dark chestnut-brown, nearly flush with eyes and nearly bare; frontal triangle considerably prominent, semi-conical, dark brown with its anterior margin bright yellow, the whole frons with depressed whitish pubescence. Antennæ black, normal. Head below antennæ with nearly parallel sides, a little narrower above,



brownish yellow, bare; mouth-opening large (proboscis broken off). Occiput projecting only a little beyond eye-margins, dark brown, nearly bare.

*Thorax* rather dark brown\*, with yellow-brown† marks as follows:—Prothoracic plates on front and hind margins and outer corners, from which latter a broad band runs nearly to each wing-base; a pair of moderately broad stripes on dorsum of mesothorax, well separated in median line, beginning at about middle of dorsum (where they are slightly wider), continuing over hind corners of dorsum just above wings, nearly to base of scutellum. A much weaker pair of slightly curved longitudinal narrow stripes on hind part of dorsum (convex sides outwards) immediately in front of scutellum. A yellow spot on propleura. Scutellum concolorous dark brown, a little darker than thorax, with distinct yellow-brown margin; pleuræ dark brown; whole thorax with a little depressed pale yellowish short pubescence.

*Abdomen* concolorous dark brown, darker apically where the pale yellow depressed pubescence is more noticeable. Extreme sides of tergites also becoming paler, forming a transition of colour to the pale yellowish venter, which also bears uniform short pale yellowish pubescence.

*Legs.* Fore coxæ yellowish; posterior coxæ concolorous brown, all trochanters a little more yellowish; hind femora yellowish, a broad indefinite brown band in middle, remainder of hind legs pale yellowish. (Rest of legs missing.)

*Wings* distinctly yellowish grey, veins dark brown; fifth vein considerably curved distally and with a short appendix; squamæ yellowish, with brown margins bearing a short golden-yellow fringe. Halteres pale yellow.

*Length* 9 mm.

Redescribed from the type (apparently a ♂) in the British Museum, in good condition except for all the legs (except one) and the proboscis being lost. The specimen is the only one of the species present and is from Saunders' collection. Walker's expression of "two diagonal stripes crossing each other" refers to the yellow anterior and posterior margins of the prothoracic plates which certainly convey this impression to a casual observer.

#### *Philopota temperata*, Walk.

*Redescription.*—♂. *Head* considerably like that of *sobria*. Pubescence of eyes yellowish white; mouth region and proboscis yellowish white; latter if bent under belly would reach tip of abdomen.

*Thorax* chocolate-brown, but the markings pale yellow; outer corners and hind margins of prothoracic plates yellow, but the anterior margins are brown. The elongate yellow stripes from middle of dorsum to its hind corners similar in shape to those of *sobria*, but their anterior ends not dilated. The two short yellow

\* Argus brown (Ridgway).

† Raw sienna (Ridgway).

stripes in front of scutellum are nearly parallel, though well separated.

*Abdomen* chocolate-brown; second segment wholly except a moderately wide median stripe, third segment on hinder half, and fourth segment on less than hinder half pale ochraceous; third and fourth segments with traces of a median dark stripe. Sides of abdomen and whole venter pale yellowish. Pubescence of abdomen wholly short, depressed, whitish.

*Legs* pale yellowish. Fore femora on upper side with a long shining brown streak; posterior femora with similarly coloured broad median band, leaving base narrowly and tip broadly pale.

*Wings* yellowish, ribbed longitudinally; veins very distinct, dark brown except lower branch of third vein and the fifth vein which are distinctly yellow; latter vein shaped as in *sobria*. Halteres yellow; squamæ yellowish, margin dark brown except on anterior side where it is yellow; fringe pale yellow.

*Length* 8 mm.

Redescribed from a ♂ in the British Museum from Saunders' collection, undoubtedly Walker's type, it being the only specimen present. The species is closely allied in general appearance to *sobria*, but is distinct on the following characters:—Anterior margin of prothoracic plates not yellow; short pale stripes in front of scutellum nearly straight, not distinctly curved, general colour of body chocolate-brown with the markings pale yellow, but more conspicuous than in *sobria*.

*Philopota flavolateralis*, sp. n.

*Head.* Eyes with a little microscopic pubescence here and there (apparently to some extent denuded), dark brown, closely contiguous from the rather small, triangular, all black vertex to the slightly prominent, elongate, triangular frons. (Antennæ broken off.) Eyes distinctly separated below antennæ by the width of lower part of frons, and then separating a little more gradually to their lower edges. Face small, almost flush with eyes, shining black in middle, upper part and sides with grey dust. Proboscis very stout on basal part, black, with microscopic pale hairs, thence changing to the yellowish remaining part; about as long as from neck to tip of scutellum. Occiput moderately broad, a little broader behind vertex, flush with eyes at sides and very slightly raised on upper part, black, with a fringe of short greyish hairs towards sides: no definite ocelli.

*Thorax* normally (*i. e.*, very) humped, minutely punctate; anterior outer angles and hind angles of prothoracic plates, an elongate spot each side of middle line of dorsum placed a little behind hind margin of prothoracic plates, a short linear stripe above wing-base, and a shorter one on posterior calli, all ochraceous yellow. Two extremely small, more brownish-yellow ones, well separated, in front of scutellum. Latter and pleuræ uniformly black, minutely punctate, latter with a little very short greyish pubescence.

*Abdomen* with deep incisions between the segments; shining black, subcylindrical, narrowing a little from base to tip; minutely punctate, apparently bare except for a little greyish pubescence towards sides. Segments, except first short one, subequally long, last (fifth) rounded apically. Sides of first segment wholly, of second broadly on more than apical half, of third on about hinder half yellowish, almost transparent. (Genitalia broken off.)

*Legs.* Coxæ and femora black, tips of latter narrowly and whole of rest of legs pale yellowish, except upper sides of tarsi mainly brown.

*Wings* clear; veins on outer parts of wing very indistinct. A large bright brown infuscation on nearly whole of costa to within a minute distance of tip of second vein, beyond which the costa ends with conspicuous suddenness. This infuscation extending hindwards, filling all first basal cell and reaching broadly over disc of wing distally up to just beyond middle, limited hindwards by anal vein, ending well before hind margin of wing. Squamæ dirty white with dark brown margin; halteres pale buff.

*Length* 8 mm.

One specimen from the Bates collection in the British Museum, labelled simply "Amazon," but probably from Para.

This species resembles *crassa*, Phil., *tristis*, Phil., and *subcylindrica*, Phil., in the central infuscation of the wing, but from the descriptions it should be distinct, and, though *gracilis*, Phil., has yellow side spots to the abdomen, the wings are uniformly brownish grey. Sex uncertain, owing to the genitalia being missing.

### *Thyllis obesa*, Erichs.

*Redescription.*—? ♂. *Head.* Vertical triangle moderately large, flush with eyes; ocelli brown, fairly conspicuous. Eyes with short blackish-brown pubescence; distinctly separated below antennæ at their point of nearest approach, but no part of the face with parallel sides\*. Face and frons together forming approximately a diamond-shaped space with the antennæ set in the centre. Face blackish. Antennæ shining brown, with long arista, set at middle of head in profile. Mouth-opening rather large, shining black. Proboscis brownish yellow, with blackish shield, reaching nearly to tip of abdomen, divided apically at same distance from tip. Occiput blackish, rather wide, with short dark brown pubescence.

*Thorax.* Prothoracic lobes butterfly-shaped, bright lemon-yellow, hind margins dark brown except broadly towards ends. Mesothoracic dorsum dark chestnut-brown, with short, dense, yellow pubescence, which is quite inconspicuous from above. A medium-sized yellow spot above base of wing, its upper margin linear, its lower margin curved; also a pair of small oval yellow spots on hind margin of thorax, placed longitudinally and well

\* In *Megalybus* the sides of the face are parallel for some considerable distance.

separated. Posterior calli with hinder half yellow. Pleuræ dark chestnut-brown, a large yellow spot occupying anterior half of mesopleura and contiguous to prothoracic lobes. Scutellum nearly black, bright yellow on about middle half of hind margin.

*Abdomen* nearly black, hind margins of all segments narrowly yellow, the colour a little wider in the middle. Pubescence yellowish grey, short, obvious on fifth and sixth segments, but less so elsewhere. Venter blackish, brownish yellow towards tip, hind margins of segments very narrowly yellowish. Genitalia orange-brown.

*Legs* mainly light chestnut-brown. fore coxæ blackish; all coxæ with short whitish-grey pubescence, rest of legs with yellowish-brown pubescence; femora shining chestnut-brown, tips broadly lemon-yellow; tibiæ more or less yellowish at base. Pulvilli and claws concolorous, apical half of latter black.

*Wings* yellowish brown, a little darker anteriorly, especially about the middle, basally a little paler. Squamæ yellowish white, with white pubescence. Halteres yellowish.

*Length* 8 mm. (exclusive of curve of body), wing 9 mm., expanse (estimated) 21 mm.

One specimen in the Paris Museum, apparently a male. Fort Dauphin, S.W. Region of Madagascar, August 1901 (*Ch. Alluaud*).

The single specimen in the Paris Museum agrees so well with Mr. Cole's recent translation of Erichson's description that the identity seems to me certain. The only differences are that in *obesa* the "front and hind margins of the prothorax are yellowish." An extension of the brown part in the centre of this region in the present specimen would fulfil Erichson's words. *Obesa* has the wings *clear*, fuscous anteriorly, costa "towards tip testaceous." This variation also seems within the limits of the present species. *Obesa* was described from the Cape. It may be noted that there is a second *obesa*, from Chili, described by Philippi, and which must not be confused with the present species. The latter species belongs to *Megalybus*, Phil., but this latter genus has by some authors been wrongfully sunk in *Thyllis*. Cole has clearly distinguished them.

#### *Thyllis crassa*, F.

Six specimens in good condition in the Paris Museum from East London, Cape, 1915 (*R. Ellenburger*), have been identified by me as this species by comparison with Cole's translation of Erichson's redescription of *crassa*, F.

#### *Thyllis turgida*, Erichs.

Four specimens in the British Museum thus named by Dr. Wandolleck by comparison with the type in the Berlin Museum. Two are labelled "Port Natal," probably the others are from there also.

*Thyllis splendens*, sp. n.

*Head.* Vertical triangle small, not raised, metallic blue, with a short stiff yellow pubescence; three indistinct ocelli. Eyes closely contiguous down to the diamond-shaped space forming frons and face, the antennæ placed in its centre, being at middle of head seen in profile; the eyes practically contiguous again immediately below face, but at once divided again by the rapidly widening mouth-opening bearing fine whitish sparse pubescence. Frons swollen, bright chestnut-brown, upper part with metallic reflections. Antennæ brownish yellow, very small, 2-jointed (unless there is an extremely small basal joint), the terminal joint approximately elongate conical with long arista. Proboscis yellowish, reaching nearly to tip of abdomen, browner towards tips, shield metallic dark green; palpi not perceptible.

*Thorax* brilliantly metallic bright green, finely punctate, with close, rather depressed, short yellow pubescence, which is inconspicuous from above; in certain lights purple reflections visible on hinder part of dorsum. Prothoracic lobes very large, distinctly ribbed transversely, only the outer sides slightly curved, hinder sides with nearly straight margins, the inner (contiguous) sides barely half as long as the outer ones (so that the general form of the entire lobes is stumpy butterfly-shaped). Anterior margin and hind corners of the lobes narrowly lemon-yellow; a very narrow yellow streak from above wing-base towards hind corners of dorsum, latter metallic green, finely punctate, with yellow pubescence. Pleuræ (hidden by legs) mainly blackish, but mesopleuræ brilliant metallic green and distinctly ribbed, anterior corners very distinctly yellow for a short space. Scutellum of rather peculiar shape, approximately a somewhat narrow oblong, with middle of front and hind margins extended in broad blunt triangular form, and the spaces between these projections and the sides gently concave; short pale yellow pubescent.

*Abdomen* distinctly 6-segmented, first segment narrow, the rest subequal in length; the second, third, and fourth subequal in breadth, fifth and sixth respectively shorter; whole abdomen bright metallic green, finely punctate, with yellow pubescence as on thorax, less conspicuous on basal segments; hind margins of third and fourth segments towards their sides distinctly swollen, and ending (each side) in two well-separated short blunt points; on second, fifth, and sixth segments only one blunt point each side is present and they are distinctly smaller. Venter concolorous with dorsum and with similar pubescence; side margins of sixth tergite continued for some distance as rather strong ribs along venter, reaching nearly to base of fifth segment. Sex uncertain.

*Legs.* Coxæ and femora metallic green, tips of latter broadly yellow, more than basal half of tibiæ, except on inner side, yellowish. rest of tibiæ, inclusive of inner sides, wholly metallic green; tips may be extremely narrowly yellowish; tarsi concolorous green. Femora almost bare, rest of legs with rather

close, depressed, yellow pubescence, which is more orange on tarsi. Pulvilli and claws orange-yellow, apical half of latter black.

*Wings* uniformly brownish grey, veins blackish brown, surface wrinkled; squamæ obscurely yellowish, margin very broadly blackish, fringe yellow, short; halteres entirely concealed.

*Length* 11 to 12 mm. (exclusive of curve of body), wing 12 mm., expanse (estimated) 30 mm.

One specimen in the Paris Museum. Bay of Antongil, Madagascar, 1908 (*A. Mocquery*).

*Helle longirostris*, Hudson.

*Redescription*.—*Head* dull blackish; eyes quite bare, closely contiguous from just below small vertex to frontal triangle; latter bright orange. Ocellar triangle flush with eyes; ocelli brown, front ocellus small, distinct, the other two larger and less well defined. Antennæ dark brown; face blackish; proboscis one a half times as long as height of head, pale yellowish above, dark brown below, the basal sheath moderately dark brown, shining. Occiput very broad above, narrowing gradually to lower part, the latter still broad, whole margin with microscopic whitish hairs.

*Thorax* dull blackish, with a slight æneous tinge, minutely punctate; outer margins of prothoracic plates and their hind corners more or less dull reddish yellow, sides and hind corners of dorsum, also pleuræ and hind margin of scutellum similarly coloured, varying a little in intensity.

*Abdomen* dull blackish with a slight æneous tinge, minutely punctate; hind margins of segments towards sides narrowly bright orange; extreme side margins of abdomen narrowly orange. Seen from in front, dorsum with rather dense, very short, fine, whitish pubescence. Venter black, hind margins of segments very narrowly orange, more or less interrupted. Genitalia mainly concealed.

*Legs*. Coxæ and femora blackish brown, trochanters and tips of femora yellowish; tibiæ and tarsi brownish yellow, dorsum of each tarsal joint blackish in middle; pulvilli yellowish, claws black.

*Wings* uniformly yellowish grey, all veins distinct; first vein with a spindle-shaped black thickened apical part; second and third veins practically parallel for their last two-thirds, third vein parallel with fourth vein as far as end of discal cell. An adventitious cross-vein sometimes occurs between third and fourth veins shortly beyond tip of discal cell, sometimes found in one wing only. No veins after third reaching wing-margin; fifth vein forming hinder side of discal cell for some distance, discal cell large; second basal cell longer than either first basal or anal. Squamæ whitish, nearly transparent, margin barely obvious, through them can be seen the large yellow clubs of the halteres.

*Length*  $3\frac{1}{2}$ –4 mm.

Three specimens in the British Museum appear to be this species. Wellington, New Zealand, 1. iii. 1910 (*Capt. F. W. Hutton*); Botanical Gardens, Wellington, 28. xi. 1906 (*W. Wesche*); Ngaiu,

N.Z., 21. xii. 1921 (*G. V. Hudson*, no. 306*f*). In the specimen captured by Wesché the adventitious cross-vein is present in the right wing only; in the one taken by Hutton it occurs only in the left wing; in the third specimen mentioned there is no trace of it in either wing.

This species was not described by Hudson, but he gave a coloured plate which simply portrays a blackish body, pale legs, unicolorous wings, with a venation which is not identical with that of *Helle*, but may be regarded as an indifferent copy of it. The apical thickening of the first vein is certainly suggestive. Hudson sent a specimen of his species to Osten-Sacken, who described it (*Ent. Month. Mag.* (2) vii. p. 17, 1896), and through the inadequacy of Hudson's plate the authorship of the species should count to Osten-Sacken, though I do not suggest any alteration now. A specimen in the British Museum under this name, by whom identified I do not know, cannot be true *longirostris* and I describe it herein as *rufescens*.

*Helle rufescens*, sp. n.

*Head* mainly as in *longirostris*, but occiput much narrower and front ocellus indefinite or absent.

*Thorax* bright brownish red, hind corners of prothoracic plates, which do not quite touch in the median line, narrowly pale yellow; dorsum with three contiguous broad black stripes; the middle one beginning on anterior margin of mesothorax, where it broadens a little, continuing to hind margin of dorsum, where it is considerably narrowed. Outer stripes beginning just in front of wing-base and ending, narrowed a little, on hind margin. Scutellum very globular, a little blackish on underside at base; metanotum more or less blackish.

*Abdomen* reddish, concolorous with thorax; a blackish, elongate, transverse spot with indefinite outline each side of median line on hinder half of each segment, more distinct on third, fourth, and fifth segments; base of each segment from fourth onwards more or less black and a little contracted. A fine microscopic whitish pubescence over all dorsum. Venter concolorous reddish with dorsum, a little blackish transversely at base of each segment.

*Legs* brownish yellow; femora, except tips for a short distance, obscurely brown; tips of tarsal joints narrowly brown.

*Wings* yellowish grey; venation as in *longirostris*, except for an extra cross-vein between third and fourth veins above tip of discal cell. All veins distinct. The elongate thickening of first vein yellowish brown, much less conspicuous than in *longirostris*. Squamæ obscurely whitish, the yellow clubs of the halteres visible through them, their margins distinctly yellow.

*Length* 7 mm.

Type from Buller River, New Zealand, 29. xii. 1918 (*G. V. Hudson*, no. 47*h*). A second specimen labelled ? Buller Riv., N. Zeal. (collector's no. 47*g*), also collected by Hudson. Both in the British Museum.

*Helle megalyboides*, sp. n.

*Head* mainly as in *longirostris*. Ocellar triangle flush with the eyes, wholly occupied by the three brownish ocelli, which are more distinct than in the other two species. Frontal triangle bright orange, a little prominent, below it a pair of whitish pubescent spots; antennæ moderately light brown. Face black; proboscis one and a half times as long as height of head, pale yellow, tip blackish, sheath brownish yellow. Occipital margin very broad (as in *longirostris*), but sloping away rapidly from hind margin of eyes, deep blue-black, finely punctate.

*Thorax* deep blue-black, finely punctate; prothoracic plates quite contiguous in median line; outer and hinder angles rather broadly brownish yellow, the same colour occurring on propleuræ, around wing-bases, narrowly thence to the reddish-orange hind margin of scutellum.

*Abdomen* of six segments, separated by deep incisions, deep blue-black, finely punctate, traces of orange narrowly towards sides of hind margins of segments. Whole dorsum of abdomen and venter with very short whitish pubescence, barely visible except from in front. Genitalia concealed. Whole abdomen in general outline (except for the deep intersegmental incisions) subcylindrical, slightly narrowing from base to tip.

*Legs*. Coxæ and femora black, tips of latter rather broadly but indefinitely yellowish. Tibiæ and tarsi brownish yellow, dorsum of tarsal joints brownish except at base.

*Wings* yellowish grey; venation as in *longirostris*, the additional cross-vein between third and fourth veins present. Clubs of halteres yellow; squamæ obscurely whitish, about basal half of disc (except margin) blackish brown; margins not differently coloured.

*Length* nearly 4 mm.

Described from two specimens in the British Museum: Wilton's Bush, Wellington, New Zealand, 27. xi. 1921 [*G. V. Hudson*, "206 e" (? c)], type; the second example labelled simply "New Zealand" (*G. V. Hudson*, "206 a" and "47 d").

## Subfamily PANOPINÆ.

*Pialea jardinei*, sp. n.

General appearance of *Physegaster maculatus*, Macq.

Head relatively larger, eyes with very long and dense blackish-brown pubescence; vertical tubercle very small, no ocelli apparent. Antennæ brownish yellow, first and second joints relatively shorter than in *maculatus*. Thoracic pubescence mainly yellowish, but with numerous black hairs intermixed; hind margin of dorsum narrowly brownish orange. Scutellum with all yellowish long pubescence. Abdomen black; hind margins of second, third, fourth, and fifth segments broadly bright yellowish orange, hind margin of the narrow first segment apparently similar. A short



sixth segment black, with grey hind margin. Belly yellowish on basal half, the segments blackish at middle of their bases; hind part of belly blackish. Pubescence of dorsum following ground-colour. All coxæ and femora brownish yellow, hind femora a little paler yellowish at base and rather brownish towards tip; rest of legs black. Pubescence of legs yellowish, but distinct, close black pubescence on tibiæ, longest on outer side of fore pair; all tibiæ spurred apically. Wing as in *P. maculatus*, except that the third posterior cell is quite closed, far from the wing-border, but not at all petiolate apically. Squamæ blackish brown, with darker margins and moderately long coarse grey pubescence.

*Length* 13 mm.

Described from a unique from the Senior White collection in the British Museum. It has the appearance of a large *Phygaster maculatus*, with the basal two-thirds of each abdominal segment black and closed third posterior cell.

Taken on the Emelina Tea Estate, Maskeliya District, Ceylon, by Mr. N. K. Jardine, in whose honour it is named. It bears a label, "On beans, bungalow garden, sunny, after rain, 5.30 P.M., 5. v. 1919."

*Pialeoidea magna*, Walk.

Eyes absolutely contiguous for nearly their full length, with dense blackish-brown pubescence. The two dull brownish fair-sized ocelli on absolute vertex (almost behind it), the tubercle nearly flush with surface. Antennæ on a small black tubercle immediately below vertex; first and second joints brownish yellow (third missing). Palpi brownish yellow with very long brown pubescence. Occiput black. Thorax brownish ochraceous, dorsum black from front to hind margin, leaving humeri wholly, side margins broadly, and hind corners pale. Pleuræ and scutellum all brownish yellow. Pubescence of all parts of thorax and scutellum pale brownish yellow. Abdomen brownish ochraceous, six-segmented, first and last short but quite obvious, all except first narrowly black on about middle half of anterior margin. Pubescence of abdomen comparatively shorter than that of thorax, brownish yellow. Venter brownish ochraceous, more or less yellowish on hind margins of segments and on each side of median line on basal segments. Legs brownish yellow; fore femora on underside, middle femora wholly darker brown; tibiæ more or less streaked with darker brown; (hind legs and all tarsi now missing). Wings uniformly yellowish grey, veins darker brown, very distinct. Halteres yellowish brown; squamæ obscurely grey, wrinkled, with very short sparse whitish pubescence, margins distinctly brownish with whitish fringe.

The type in the British Museum is in good condition, and the above notes have been made from it.

*Physegaster maculatus*, Macq.

Type, from Algeria, in Paris Museum in good condition. Eyes with long but not particularly dense black pubescence; contiguous from well-raised ocellar tubercle to the rather elevated triangular frons; well separated below antennæ. (Vertex too dirty to see if ocelli are present or not. Macquart neither mentions nor figures them.) Antennæ rather dark brown, drooping beneath the frontal prominence; first and second joints considerably bristly on upper side towards tips. Mouth-region squarish, blackish, no sign of proboscis. Face moderately broad, with nearly parallel sides, barely broader above and below. Thorax normally shaped, thick, black, humeri yellowish, scutellum normal, all with long and rather dense yellowish pubescence. Abdomen yellowish, with black markings as in Macquart's figure, the pubescence following the ground-colour. Fore coxæ yellowish, posterior pairs blackish, remainder of legs yellowish, tarsi a little brownish towards tips.

By the size the antennæ are figured in Macquart's plate one is led to suppose they are exceptionally large, but in reality they are about three-fourths the height of the head, drooping, placed at about two-thirds of the distance from vertex to lower part of head. The third posterior cell is distinctly open, but the sides distinctly curve a little towards each other.

The species has not been recorded since its erection.

## PHYSEGASTRELLA, gen. nov.

Allied to *Physegaster*, Macq., but differing radically in the quite bare eyes, with the secondary character of the third posterior cell being closed before the wing-margin. It resembles *Physegaster* in the shape, size, and position of the antennæ, the absence of ocelli and a proboscis, and in the general structure, the oblongo-conical shape of the abdomen, and a general thick-set build. Type, *P. maroccana*, sp. n.

*Physegastrella maroccana*, sp. n.

*Head.* Vertical triangle small, dark grey, mainly occupied by the round black ocellar tubercle, barely raised; no ocelli. Eyes closely contiguous down to the raised, bare, shining black frontal triangle; eyes below antennæ comparatively broadly separated by the face, which is long, with approximately parallel sides, grey-dusted. Mouth-region distinct, but no apparent proboscis. Antennæ brownish yellow, bare, first joint darker. Occiput moderately prominent, rather dark-grey dusted, with some black bristly hairs.

*Thorax* shining black, except the rather large bright yellow humeri; dull yellowish about hind corners and on prothorax above fore coxæ. Pleuræ and scutellum black; mesopleuræ swollen; some rather ragged yellow pubescence here and there on anterior margin

of dorsum, on humeri, pleuræ, and about the wing-bases \*. Scutellum almost subtriangular.

*Abdomen* moderately shining blackish brown, hind margins of second and third segments yellowish, the colour much broader towards sides; hind margins of other segments indefinitely yellow. A little bright yellow, comparatively long pubescence on first segment, remainder of abdomen comparatively bare. Venter shining black, nearly bare, hind margins of segments narrowly yellowish. Genitalia concealed by the broad, thin, oblong, black ventral plate with a yellow longitudinal stripe in middle.

*Legs.* Coxæ shining yellowish brown, remainder, including pulvilli, yellow, with short concolorous pubescence; claws black.

*Wings* short, clear, venation very distinct; squamæ blackish with yellow rims and pubescence; halteres yellowish.

*Length* 10 mm., wing about  $6\frac{1}{2}$  mm., expanse (estimated) about 16–17 mm.

One specimen of uncertain sex in the Paris Museum from Morocco, 1905 (*G. Buchet*).

There is a general resemblance of this species to *Physegaster maculatus*, Macq., but confusion need not occur if attention is given to the bare eyes and closed third posterior cell of my species. Otherwise the description of one species applies tolerably well to the other, and as both come from North Africa misidentification is made more probable.

*Astomella curviventris*, L. Duf.

Several specimens in the Paris Museum, mostly without data, one example being 13 mm. in length. As the abdomen is considerably curved the real length, with extended abdomen, would be greater.

*Camposella insignata*, Cole.

One specimen in the Paris Museum in excellent condition of this extraordinary Cyrtid from Ecuador (? Quito), from which country it was originally described. The gigantic antennæ and complete absence of pulvilli separate the species from all others in the family. Its size, too, is quite exceptional, 17 mm. in length and about 33 in wing-expanse. In the above specimen the front side of the quite thin third antennal joint is very definitely cut away for a small space just below its middle. Cole gives an excellent full figure of the insect (*Ent. News*, xxx., frontispiece to Dec. part, 1919).

*Pterodontia flavipes*, Gray.

Two species have been confounded under the name *flavipes*, as noted by Westwood. *P. flavipes*, Gray, in Griffith's 'Animal Kingdom' has priority, the type being in the British Museum

\* The dorsum and scutellum have the appearance of having been covered with similar, though possibly finer, pubescence.

from Georgia. In 1835 Macquart described (*Suite à Buff. ii. p. 515, pl. xxi. 5b, Pterodontia*) a species from Australia, classifying it amongst the Acalyptrata. Later (*Dipt. Exot. i. 2, p. 175*), in redescribing the genus, he puts it with other Cyrtids, and in a footnote admits that his previous figure (*Suite à Buff.*) was that of an Acalyptrate (*Trigonosoma perilumpiformis*) given in error for his *P. flavipes*. Westwood in 1848 (*Trans. Ent. Soc. v. p. 97*) noted the confusion of two species and renamed Macquart's species *macquartii*. Macquart (*Dipt. Exot. ii. 1, pl. i. fig. 2*) gives a good figure of the true wing. However, later (*Dipt. Exot. ii. 3*) he again blunders, as in *pl. xxxix. fig. 3* he gives a head of an Acalyptrate, again placing the species (*p. 252*) amongst the Acalyptrates, and in *fig. 3a* he gives a figure of what is obviously intended to represent a *Pterodontia* wing. The figure of the Acalyptrate's head is probably another error. The Kertész Catalogue quotes this particular reference, but, curiously enough, omits *fig. 3a*, although this particular figure seems to prove that Macquart really had a *Pterodontia* before him.

Gray's type of *flavipes* is now a little discoloured. Head and thorax black, with dense blackish-brown pubescence; abdomen brownish orange, first segment hardly visible, second all black, third with broad median black stripe; legs pale yellowish, fore femora more brownish orange, posterior femora all black to tips; wings clear. Length  $8\frac{1}{2}$  mm. A single specimen.

A specimen in the Paris Museum, identified by me, is from the "Environs d'Icarno, Bords du Rio Salado, Chaco do Santiago del Ester." In this specimen the humeri, hind corners, and the side margins of thoracic dorsum and all the scutellum are livid yellowish; abdomen orange-yellow, with a moderately broad median black stripe nearly to tip; basal half of all femora broadly black, the colour not well delimited.

*Pterodontia macquartii*, Westw.

*Pterodontia flavipes*, Macq., nec Gray.

*Pterodontia analis*, Macq., nec Westw.

Two specimens in the Paris Museum, named by Macquart. A specimen of *P. analis*, Macq., in the same collection and named by the same author, is in my opinion synonymous.

*Pterodontia smithi*, Johns.

Mlanje, Nyasaland, 10. i. 1913 (*Dr. S. A. Neave*). One specimen in the British Museum obtained through the Imperial Bureau of Entomology, agreeing very closely with Johnson's description.

*Pterodontia analis*, Westw.

♂. Vertical tubercle well raised, black; eyes with dense brown (not black) pubescence. Thorax black, with dense brown (not black) pubescence; scutellum black. Abdomen dark brown,

densely pubescent; first, second, and third segments black, fourth with a contiguous rounded spot in middle of front margin, nearly reaching hind margin. Rest of abdomen bright chrome-, almost orange-yellow; fourth segment with a very small dark spot in middle of front margin; a distinct fifth segment with still smaller similar spot. Venter obscurely whitish. Legs pale yellowish; femora a little more brownish; femora and tibiae with obvious brown pubescence. Genitalia broken off. Apparently ♂.

The type is in fairly good condition (British Museum). Wings absolutely clear, conspicuously ribbed transversely; costal prominence pale yellowish; squamæ obscurely brownish yellow, with conspicuous broad black-brown margin and brown pubescence; halteres pale yellowish.

Westwood's description is very good, but the above notes may be of interest.

*Pterodontia dorsolineata*, Brun.

One in the Paris Museum from Solen, India, 1907 (*R. Oberthür*), identified by me.

*Pterodontia wazelii*, Klug.

One specimen, north of Pekin, named by Wandolleck (Paris Museum).

*Pterodontia mellii*, Erichs.

Two specimens in excellent condition in the British Museum from Townsville, North Queensland (*F. P. Dodd*), with a third from Saunders' collection. *P. flavipes*, Gray, seems sufficiently distinct to be valid. In *mellii* the median abdominal black stripe extends, narrowing slightly but without loss of intensity, to the tip, the posterior tibiae wholly black and the hind corners of the thoracic dorsum wholly black also. The great difference in the localities of the two species also presupposes distinctness. The Queensland specimens measure 10–11 mm. The name *flavipes* has priority over *mellii*.

*Epicerina nigricornis*, Macq.

The type of this species, recorded from Tasmania and as being in the Paris Museum, was considered lost, but an unnamed specimen found by me in the collection appears to be the missing genotype. It bears a red label (representing the Australian Region), and a register number which M. E. Seguy kindly informed me means that it was collected by M. J. Verreaux in Tasmania in 1847. It agrees well with Macquart's description and figures of full insect and head in profile, with one serious discrepancy. Macquart states and figures the proboscis as very short, whereas it is long enough to reach under the belly to the tip of the thorax. Premising this serious oversight (because, as a matter of fact, it is easy to overlook the proboscis when it is closely

pressed to the underside of the body), there is nothing to prevent its identity with *nigricornis*. The venation agrees exactly, the black abdomen with blue reflections is characteristic, the tibiæ though streaked with black (described as yellow) have the outer side yellowish in the middle pair and the hinder side yellowish in the hind pair. The alleged whitish dust on the abdominal incisions is accounted for by a little short whitish pubescence towards the sides at the bases of several of the segments. The frons is a very small triangle just below the inner upper corners of the eyes. Macquart's expression of it being in the male a "linear point between two triangles" is difficult to explain.

Taking all the points into consideration, the specimen in question is very probably the type.

*Epicerina conspicua*, sp. n.

*Head* set close on thorax. Eyes bare, well separated at point of nearest approach above, but closely contiguous below antennæ down to lower part of head. Vertex only slightly raised above level of eyes; three distinct dark brown ocelli in triangular position just above nearest approach of eyes. The small frons black, bare. Antennæ a little below vertex in profile, all black, bare; first and second joints very short, nearly annular, third long, linear, quite bare, very gradually narrowing a little to tip, rather compressed laterally. Full length of antennæ nearly equal to that of height of head. Face occupied by the black sheath of the yellowish slender proboscis, which reaches below body nearly to tip of thorax.

*Thorax* finely punctate; humeri well demarcated, lemon-yellow; dorsum of thorax brownish orange, with three contiguous broad black stripes nearly filling whole surface except behind the humeri, along side margins, posterior calli, and (more broadly) in front of scutellum. Pleuræ shining metallic deep blue; scutellum purplish blue, a little brownish orange towards sides.

*Abdomen* a little longer than thorax, as broad as thorax at base, very slightly wider at about the middle. First segment rather narrow, shining deep blue; second and third longer, subequal; fourth and fifth shorter than second and third but subequal to each other; all four segments brownish orange, with a trace of a very narrow shining blue line at their bases. Sixth segment shining blue, a similarly coloured spot in middle of hind margin of fifth segment. Whole abdomen with barely noticeable yellow pubescence. Venter finely punctate, shining blue, sides broadly brownish orange.

*Legs* dark shining blue; knees, base of tibiæ, and the tarsi yellowish; all tibiæ with distinct apical spines.

*Wings* uniformly yellowish brown, thoracal squamæ dirty grey with coarse concolorous hair; halteres orange.

*Length* 13 mm.

A unique in the British Museum. Kalamunda, S.W. Australia,

14. iii.-14. iv. 1914 (*R. E. Turner*). The genital organs are complex, but are withdrawn within the ventral cavity, and the sex of the insect is not easily ascertainable.

A very conspicuous, robust species with venation and antennæ altogether typical. The first posterior cell is a little longer and the discal cell a little shorter than in Macquart's plate. That author says the proboscis is short, that of my new species is of considerable length.

#### MESOPHYSA, Macq.

This genus is wrongly sunk in *Panops* in Kertész's Palæarctic Catalogue, as the two species for which Macquart formed it have completely bare eyes. The types are in the Paris Museum in sufficiently good condition to be quite recognizable, and M. Seguy kindly supported my opinion as to the bare eyes by carefully examining both types under a microscope. Macquart designated no type, and I therefore select *scapularis* the first species. A character which is markedly present in both species is the appendix to the upper branch of the third vein, a feature which has not been seen by me in any species of either *Lasia* or *Panops*. The Kertész Catalogue sinks *scapularis* as synonymous with *flavipes*, Latr., and *marginata* as synonymous with *baudini*, Lam.

#### *Mesophysa flavipes*, Latr.

##### *Mesophysa scapularis*, Macq.

Eyes absolutely bare; two definite brown ocelli on low, vertical, black tubercle; vertex wrinkled. Antennæ placed a little below vertex, nearly filling the diamond-shaped frons; first and second joints nearly annular, third as long as height of eyes, lanceolate, very slightly widening towards the blunt tip. Mouth-opening at bottom of head, triangular, with clear-cut yellowish border. Shield of proboscis prominent, but comparatively short, shining brown; proboscis brownish yellow, extending below body to second abdominal segment. Two small palpi at base of proboscis, apparently one-jointed, cylindrical, with pointed tips and a short pale apical bristle.

Humeral lobes large and conspicuous, separated by about one-fifth full width of dorsum, bright yellow. Abdomen distinctly less curved than in *Lasia*, of six distinct segments, fifth segment with parallel sides, sixth shortly conical. The gold pubescence most conspicuous on fifth segment. Femora black, rather broadly yellow at tips; remainder of legs yellowish. Wings distinctly pale brown from costa down to third vein, including first posterior cell.

*Length* about 12½ mm.

Macquart said the type probably came from the Cape, and the probable type-specimen at Paris bears no data except a label in Macquart's handwriting with the specific name. A separate label not affixed to the specimen gives the locality as New Holland. Wiedemann says the species (as *Lasia flavipes*, Latr.) has three

distinct lines on the thorax, of which I can perceive no trace. It also differs from *flavipes* in the mainly black femora.

*Mesophysa baudini*, Lam.

*Mesophysa marginata*, Macq.

The single specimen at the Paris Museum under this name, without data and in bad condition, is named by Macquart and is probably the type of the species. It agrees fairly well with Wiedemann's description of *baudini*, but the bare eyes should prevent it being synonymous. At any rate, should *baudini* possess bare eyes it must be referred to *Mesophysa*.

Humeral lobes separated from one another by nearly one-third width of dorsum. Eyes nearly meeting above the very small, almost diamond-shaped frons in which are set the antennæ, of which the first and second joints are annular (third joint missing). Antennæ contiguous at base. The eyes meet again directly below the frons and apparently continue in close contact to their lowest points\*. Wings rather pale brown, the central parts of the larger cells paler.

*Length* 13 mm.

Amongst some unnamed Cyrtidæ at the Paris Museum I found a second specimen of the same species without data, beyond a small label signifying the Australian Region. It is in fair condition and agrees well with the type.

*Apsona cærulea*, sp. n.

*Head.* Eyes with long, dense, bright rufous-brown pubescence, apparently contiguous, but actually sufficiently separated to show a very narrow shining metallic blue space between them throughout, from the shining, almost blue-green frons bearing long, black, rather shaggy hair to the narrow shining black triangular frons. Antennæ elongate, very slender, first joint very short, cylindrical, brown with a little grey dust; second much thicker, nearly as broad as long, subcylindrical, brown, with some stiff bristly hairs at tip; third very slender, pale yellow, nearly three times as long as second, basal half cylindrical, very much narrower than second joint, apical half elongate conical, narrowed at base, with long fine apical arista. Proboscis long, slender, *Lasia*-like, sheath bright shining metallic blue, much longer than full length of body, black. Occiput metallic blue, with long shaggy dark grey hair.

*Thorax* shining metallic blue with green reflections and long, rather coarse, blackish hair, more greyish towards sides. Scutellum more than twice as broad as long, with concolorous pubescence, hind margin gently curved, with more whitish pubescence.

*Abdomen* shining metallic blue, with rather long, fine, black pubescence. Two peculiar and conspicuous small patches of much

\* The head at this point is not in sufficiently good condition to speak with certainty.



denser black hair on discs of second, third, and fourth segments, well separated. Belly shining violet, with black pubescence.

*Legs.* Femora and tibiae shining dark brown, with a little fine black pubescence; tarsi yellowish (except the black tips), with yellowish pubescence, which latter also occurs on inner sides of tibiae on about apical half.

*Wings* quite clear yellowish grey; venation normal except fork of third vein much more upturned than in type-species, and fourth posterior cell almost contiguous at its pointed base with tip of second basal cell. All endings of fourth vein not reaching wing-margin. Alar squamæ yellowish, bare, black-fringed; thoracal squamæ ferruginous, with rather long shaggy depressed whitish hair. Halteres concealed.

*Length*  $7\frac{1}{2}$  mm., proboscis 9 mm.

A unique of uncertain sex in the British Museum, Minas Geraes, Brazil (*Rogers*), from the Saunders collection. The only previously known species is *muscaria*, Westw., the genotype from New Zealand.

*Leucopsina odyneroides*, Westw.

On the (presumably) unique type, in good condition, in the British Museum I offer the following notes:—

Head all black (now injured by some gum-like liquid), except the two small basal antennal yellowish joints: antennal third joint wholly black. Thorax finely punctate, wholly black, except the large humeral pieces and a narrow edge to the hind corners of the dorsum, which are bright chrome-yellow. Abdomen black, finely punctate, hind margin of first segment very narrowly yellow; a squarish spot on each hind corner of the narrowed second segment, a broad clear-cut band on hind margin of third segment, all these markings chrome-yellow; sixth segment with a little yellowish depressed pubescence. Venter with yellow marks agreeing with those on second and third tergites. Legs yellowish brown, femora, except at base and tip, a little darker brown. Pubescence of legs very short, whitish. Wings yellowish grey, considerably darker brown anteriorly down to third vein, the colour spreading basally a little further hindwards. Halteres with stems yellowish and clubs blackish. Squamæ brownish, greyish anteriorly, margin darker brown, disc with short whitish pubescence.

*Length* 11 mm.

Sex indeterminable, as genitalia completely concealed. New South Wales.

*Eulonchus sapphirinus*, Ost.-Sack.

One specimen in the British Museum of this beautiful species, named by Mr. F. R. Cole, from Forks, Clallam Co., Washington, 2. vii. 1920.

*Eulonchus tristis*, Lw.

The same collection has recently been enriched by the presentation by Mr. R. C. Shannon of a specimen of *tristis*, Lw., from the mountains of Moscow, Idaho, viii. 1910.

*Eulonchus smaragdinus*, Gerst.

A specimen thus identified by me from Cerro Colorado, Dep. de Florida, Uruguay (*P. Serre*, 1921). In Paris Museum.

## EULONCHIELLA, Meun.

An ancestral form, presumably, of *Eulonchus*, may be noted here as having been comparatively recently described by Prof. Meunier (1912) from Baltic amber, *E. eocenica*.

## Subfamily CYRTINÆ.

*Psilodera fasciata*, W.

A short series of this species in the British Museum. Bluff, Durban, Natal, 2. iv. 1913; Umbilo, Durban, 26. v. 1913 (both *A. L. Bevis*); Barberton, S. Africa (*P. Rendall*); and one or two others from Port Natal.

A specimen in the same collection of this species, which appears to be the commonest of the South African ones, has the upper branch of the third vein joined to the second vein just before the tip of the latter. Pubescence of thorax uniformly brownish grey. Abdominal bands less clearly cut and more brownish yellow than in typical specimens, the band on second segment wider than usual. The whitish pubescence, limited in extent, which occurs in typical *fasciata*, viewed best from in front and seen to be more definite in the median line and towards the sides of the hinder segments, is in this individual quite absent, the pubescence of the whole abdomen being uniformly dark brown. In all else as in normal specimens. The sex is uncertain, the genitalia being concealed. The specimen was taken at Karkloof, Natal, ii. 1897 (*Dr. G. A. K. Marshall*).

*Psilodera contigua*, sp. n.

Very near *fasciata*, W., and liable to be mistaken for it, but differing by the following characters. Pubescence of thorax with relatively much greater difference in colour between that of the anterior half, which is whitish, and that of the posterior half, which is bright brownish yellow, the line of demarcation between the colours being indefinite. In *fasciata* the pubescence is mainly pale yellowish grey with less contrast between the anterior and posterior portions. Hind marginal bands to abdominal

segments in *contigua* more clearly cut and equally distinct on all segments, whereas in *fasciata* they are less distinct on the hinder segments. In *contigua* the whitish pubescence on basal half of venter more conspicuous than in *fasciata*. Finally, the two branches of the third vein definitely converge towards their tips, but in *fasciata* they either diverge or are, at most, parallel. The costal region is blackish brown in *contigua* from about its middle, limited hindwards approximately by second vein, the colour varying in extent and intensity but always deep and conspicuous. In *fasciata* this region is not appreciably darker. The third posterior cell has a distinctly shorter petiole in *contigua*.

Eight specimens in the British Museum from Mossel Bay, Cape Province, Oct. 1921 (*R. E. Turner*).

*Psilodera valida*, W.

Two in the British Museum from Mossel Bay, Cape Province, 18-30. xi. 21; xii. 1921 (*R. E. Turner*). A third specimen from the Cape in the same collection received from the Entomological Club.

*Psilodera bipunctata*, W.

*Psilodera capensis*, Gray.

The type of *capensis*, Gray, from the Cape of Good Hope, in the British Museum, with a specimen of *bipunctata* also from the Cape, agreeing entirely with Wiedemann's description proves it to be synonymous with this species and not with *fasciata*, W., as erroneously quoted in the Kertész Catalogue. Two other specimens in the same collection show the following slight differences. The small yellow spots in front of the scutellum are rather larger and more wedge-shaped, the basal half of the scutellum is blackish, all the abdominal segments have a small spot in the middle of the base, the yellow hind margins almost disappear in the middle, and there is a transverse elongate spot at the basal corners of third, fourth, and fifth segments.

*Cyrtus gibbus*, F.

*Cyrtus pusillus*, Macq.; *Cyrtus dentatus*, Macq.

In an excellent series in the Paris Museum can be found intermediate forms uniting these three supposed species. In *gibbus* the large yellow spots on the anterior corners of the dorsum, behind and contiguous to those of the prothoracic lobes, are smaller relatively, oval, and placed longitudinally; in *dentatus* they are larger and triangular. In *gibbus* the large yellow spots on the hind corners of the abdominal segments reach their greatest size, the central lobe in each spot being broad, rounded, and directed towards the middle of the base of the segment. In *dentatus* the spot tends towards a three-fingered shape, two fingers lying respectively along the hind and side margins, the third finger

intermediate, all joined in a common broadened base. In *pusillus* the spot is reduced to an elongate one along the hind margin, and carried up the side margin for a varying distance, the intermediate finger obsolete or absent. The type of *dentatus* is in very good condition, Macquart's figure of it being quite correct. There are also three specimens under the name *pusillus* in the Pandellé collection. The full series referred to contains specimens from many French localities, including St. Guildo, North Coast: Eastern and Hautes Pyrenees, Lyon, Rhone Province; Monet, S. France; etc. Also there are specimens from Algeria, June 1894 (*Surcouf*); Ain Draham, Tunis; Tangiers.

In the British Museum under one or another of the three specific names from Spain, Gibraltar, South France, and Algeria.

*Cyrtus nyasæ*, sp. n.

*Head.* Eyes very approximate for a very short distance only, near top of head, bearing long, dense, brown pubescence. Vertex with long, dense, black-brown hair. Frons black, nearly bare; lower margin yellowish. First and second antennal joints black, narrowly yellowish at tips, as is also third joint at base, the remainder being dull reddish brown. Face black, nearly bare; proboscis shining black; occiput black, with black pubescence.

*Thorax.* Dorsum and pleuræ shining black; hind corners of dorsum, also scutellum, wholly brownish yellow; whole thorax with long, dense, brownish-yellow pubescence.

*Abdomen* black; hind margins of second and third segments broadly, those of first and remaining segments narrowly yellowish; venter yellowish, about basal half of segments black. Pubescence of dorsum black, of venter yellowish.

*Legs.* Femora black, remainder yellowish; claws black, pubescence of legs yellowish.

*Wings* yellowish grey; venation normal and distinct; thoracal squamæ yellowish grey, with concolorous pubescence on surface and margin; halteres moderately large, yellowish.

*Length* 8 mm.

A unique specimen. Mlanje Plateau, Nyasaland, 6500 ft., 12-14. xi. 1913 (*Dr. S. A. Neave*).

SUBCYRTUS, gen. nov.

Differing from *Cyrtus*, Latr., mainly by the proboscis being extremely short and stumpy—barely protruding from the mouth-opening, instead of being very long and thin. The eyes are practically bare, instead of hairy. Type-species, *splendens*, sp. n.

*Subcyrtus splendens*, sp. n.

♀. *Head* black, the dark red ocelli on a small but conspicuously elevated prominence; antennæ placed just below vertex, brownish yellow; occiput rather prominent, grey, with a little bright yellow

pubescence behind vertex and on lower margin. Proboscis extremely short, stumpy, yellowish. Eyes practically bare, but a few microscopic hairs visible under a high magnifying power, dark brown, facets of moderate and uniform size.

*Thorax* considerably humped, dorsum brilliantly shining metallic green, with rather long but not dense brown pubescence; humeri large and with pleuræ brownish æneous with violet reflections; mesopleura very strongly developed; anterior stigmata conspicuously pale yellowish. All pleural pubescence yellow, not dense. Scutellum deep metallic blue with brownish-yellow pubescence; frenulum well developed, brownish yellow.

*Abdomen* one and a half times as long as thorax, barely wider, well inflated, shining violet; hind margins of segments just perceptibly pale yellow; pubescence moderately long and dense, dark brown. Belly yellowish, with darker markings and rather long yellow pubescence; genitalia rather small, yellowish.

*Legs* pale yellowish, with short concolorous pubescence.

*Wings* yellowish grey; venation normal, dark brown; halteres yellowish white, conspicuous; squamæ dirty yellowish grey, with yellowish pubescence.

Described from a unique ♀ in the Indian Museum. Darjeeling, 6000–7000 ft., 11. vi. 1914 (*Gravely*).

#### *Opsebius pepo*, Lw.

One in British Museum from Branuelas, Leon, Spain, taken by Mr. G. C. Champion in 1906, named by Mr. J. Arias.

#### *Table of Species of Acrocera* \*.

1. Third vein forked .....	2.
Third vein simple .....	9.
2. Thorax bright yellow, with three conspicuous long black stripes .....	<i>trigramma</i> , Lw.
Thorax never so .....	3.
3. Abdomen mainly yellowish or reddish .....	4.
Abdomen mainly or wholly black ..	6.
4. Abdomen reddish orange; a row of median small black spots .....	<i>sanguinea</i> , Mg.
Abdomen yellow, base and sides of second segment black; with irregular small black marks on rest of abdomen or none .....	5.
5. Last tarsal joint always more or less definitely black up to about half .....	<i>globulus</i> , Panz.
Last tarsal joint wholly whitish .....	<i>unguiculata</i> , Westw.
6. Apical half of basal abdominal segments yellowish. Abdomen practically wholly dark .....	<i>subfasciata</i> , Westw.
7. Two pairs of large though not conspicuous pale abdominal spots ..	7.
Abdomen entirely dark .....	<i>plebeia</i> , sp. n.
8. Larger sp., 5 mm. Wings clear, third vein very definitely forked, both branches reaching wing-margin .....	8.
	<i>nigrina</i> , Westw.

\* This table contains only species present before me simultaneously.

- Smaller sp., 2½ mm. Wings slightly smoky yellow basally; upper branch of third vein indistinct ... *fumipennis*, Westw.
9. Abdomen on basal half black; apical half yellow, with a median elongate black spot joined by a short stripe to the black basal part ..... *infurcata*, sp. n.
- Abdomen yellowish, extreme base and sides on basal half narrowly black; anterior margin of third segment narrowly black; a small basal spot on fourth segment ..... *bullæ*, Westw.

*Acrocera globulus*, Panz.

This variable species, the ground-colour ranging from orange-yellow to nearly white, the proportionate extent of black in the abdomen to the paler parts also being variable, is well distributed in France, especially in August. Localities outside of France are Franzenbad, Bohemia; Algiers, vi. 1914 (*Surcouf*); Abyssinia, 6. xii. 1907 (*H. Latham*). Four specimens in British Museum from Salisbury Plain, Wiltshire, 3. viii. 1909 (*Maj. E. E. Austen*); also one taken on Wimbledon Common by Mr. E. C. Rye, 4. vii. 1858.

*Acrocera sanguinea*, Mg.

In the various small collections at the Paris Museum are several specimens of this robust, striking, reddish-orange species, but mostly without data. One specimen is from Fontainebleau.

*Acrocera trigramma*, Lw.

Another very striking species, with all yellowish thorax and three very distinct longitudinal black stripes. Camargne (*L. Puel*). and Environs of La Castres (both S. France); Vernet les Bains, E. Pyrenees, vi., viii. 1921 (*R. Oberthür*).

*Acrocera bulla*, Westw.

♀. The type is now rather dirty, but most of its characters are observable. Thorax all black; anterior and posterior corners also, but prothoracic stigma yellowish\*; scutellum all black. Abdomen ochraceous yellow, first segment barely visible; second segment broadly dark brown basally and towards sides, the colour forming the beginning of a short basal dorsal stripe; third segment as first, the brown colour rather less extensive; fourth segment with a roundish spot in middle of anterior margin and on each anterior corner; fifth segment all brown. Genitalia prominent, dark brown with yellow appendages. Venter yellowish, more brownish laterally towards tip. Fore and hind legs yellowish (middle legs missing). Wings with first vein rather thickened on distal part; second vein absent, and third vein unforked, only the upper branch being visible,

\* As the humeri in so many species are yellowish, the prothoracic stigmata might, on casual observation, be mistaken for them.

and for a short distance at base only; fourth vein also unforked. Halteres yellowish; squamæ obscurely grey, not transparent.

Length about  $4\frac{1}{2}$  mm.

Cole states the species was described from Georgia, but this is an error, the type being the only specimen present in the British Museum, and it is definitely labelled New York, as stated in the original description.

*Acrocera nigrina*, Westw.

♀. Westwood's description, though short, is quite good. Head and thorax black, dorsum of latter shining, humeri brownish yellow, posterior corners of dorsum similar, the colour extending forwards a little towards bases of wings; pubescence of dorsum brownish yellow; scutellum shining black. Abdomen dark brown; spots on fourth tergite elongate, narrowed on hind margin, well separated; fifth tergite practically all black with a narrow yellow hind margin. Genitalia prominent, but some parts have been broken off, leaving, however, a large obtuse dark brown basal piece with the tip pale yellowish and a pair of large flat broadly elongate apical pieces. Legs pale brownish yellow, femora (except base and tips narrowly) distinctly more brownish. Wings pale grey, veins distinct: first vein thickened on distal part from about opposite tip of auxiliary vein, stigma-like, narrowing and ending just beyond tip of upper branch of third vein; second vein entirely absent; squamæ obscurely whitish, margins narrowly brownish yellow.

Length 5 mm.

The only specimen in the British Museum is the type, although Westwood described the species from more than one individual, as he says: "second vein usually entirely lacking, there may be a basal rudimentary stump." Johnson notes a specimen from Quebec with incomplete second vein.

*Acrocera unguiculata*, Westw.

Head all black. Thorax black, anterior corners with a conspicuous small, yellow, elongate spot; hind corners much more broadly yellow, the colour extending forwards towards wing-bases; scutellum all black. Abdomen bright but pale orange-yellow; first segment extremely short, yellow; second segment dark brown basally and broadly so at sides, with a wedge-shaped median stripe reaching to middle of segment; third segment more narrowly at sides, and also a small triangular spot in middle of front margin, brown; fourth segment with a rather small curved spot on each anterior corner and a very small spot in middle of front margin brown; fifth segment (withdrawn) apparently all pale yellow. Venter wholly very pale yellow; two first basal segments a little brownish towards sides. Legs whitish yellow; tips of last tarsal joint and claws black. Wings very pale grey; veins obvious, but weak:

first vein not thickened, second quite absent. Halteres yellowish, squamæ nearly transparent, margins not appreciably darker.

*Length*  $3\frac{3}{4}$  mm.

In the single specimen (type) in the British Museum the genitalia are too concealed to determine the sex with certainty, but it appears to be a male.

Cole records several specimens from North America, one of them 5 mm. long. In his descriptive notes he says the humeri and postalar callosities are black, but they are strikingly yellow in the type—otherwise, allowing for the usual variation of individuals in this family, his remarks apply very well to the species.

*Acrocera subfasciata*, Westw.

The anterior corners of the thoracic dorsum have large subtriangular brownish-yellow spots, the hind corners are narrowly yellowish. Basal abdominal segments brown, with about apical half of each yellowish; apical half of abdomen with small, indefinite, yellow and black marks. Venter pale yellowish. Legs wholly pale yellow, tarsi tips and claws black. Wings with first vein thickened on distal part; second vein present, ending just beyond fork of third vein. Halteres yellowish, clubs with a black spot in middle.

*Length* 3 mm.

The single specimen in the British Museum is the type, in indifferent condition. As the genital organs are missing, the sex is undiscoverable.

*Acrocera fumipennis*, Westw.

Head now missing from the type (British Museum). Thorax black, anterior corners of dorsum with a very narrow brownish-yellow spot, posterior corners more obscurely similarly coloured. Scutellum black. Abdomen (damaged) shining dark brown, blackish in parts. Wings very pale yellowish grey, barely appreciably darker basally; first vein only a little thickened distally, second vein absent, third vein with anterior branch visible only at base. Halteres yellowish; squamæ obscurely grey, margins narrowly yellowish. Legs missing except one, probably a fore leg, which is whitish yellow.

*Length*  $2\frac{1}{2}$  mm.

*Acrocera infurcata*, sp. n.

♂. *Head*. Eyes bare, facets of moderate, uniform size; vertex moderately large, black, with black pubescence and pale yellowish ocelli; occiput blackish grey with black pubescence; antennæ pale yellowish.

*Thorax* and scutellum shining black, with dark brown rather dense pubescence.

*Abdomen* black, with short black pubescence. On hind margin of second segment a rather large, oblong, transverse, yellowish spot (with a small vertical stripe in its centre) occupying more than



half hind margin, and narrowing at sides; third segment yellow, with side margins anteriorly narrowly black, and a quadrate black spot on front margin with a narrow black stripe from the spot reaching nearly to hind margin of segment. Fourth segment all yellow. Genitalia moderately large, black. Belly yellowish.

*Legs* uniformly pale yellowish.

*Wings* colourless, anterior veins yellowish; third vein unforked; squamæ dirty grey; halteres conspicuously pale yellow.

*Length* about  $1\frac{3}{4}$  mm.

Described from a unique ♂ in the Indian Museum from Pipera, Gonda Distr., United Provinces, India, 9. iii. 1909.

In this genus the third vein is normally forked, and its unforked state in the present species should easily identify it from the only other Oriental species, *plebeia*.

*Acrocera plebeia*, sp. n.

♂. *Head* black, vertical triangle comparatively large, and, with the black occiput, bearing a little dark brown or black pubescence.

*Thorax* and scutellum shining dark brown, with short, dense, black pubescence; humeri a little paler.

*Abdomen* shining dark brown, segments very indistinctly outlined; a paler indistinct space on central part of hinder half of second segment; a similar paleness almost resolved into two elongate pale yellowish spots on third segment; hind margin of third segment rather pale. Genitalia comparatively large, blackish brown.

*Legs* uniformly dirty yellowish.

*Wings* pale grey; venation normal; squamæ dirty white.

*Length* about  $3\frac{1}{2}$  mm.

Described from a unique ♂ in the Indian Museum from Pashoke, Darjeeling District, 3500 ft., 26. v.-14. vi. 1916 (*Gravely*).

*Table of Species of Oncodes* \*.

1. Thorax with ground-colour pale; yellowish or pale brown.....	2.
Thorax with ground-colour dark; brown or black .....	8.
2. Scutellum wholly, or with some definite part yellowish or at least contrasting conspicuously with the black or dark brown remainder .....	3.
Scutellum black or dark brown, with definite pale parts .....	6.
3. Conspicuously characteristic species † .....	4.
Less conspicuous species .....	5.

\* By ground-colour is intended the general colour of the thoracic dorsum, especially on the margins. The presence of three broad contiguous black stripes nearly filling the surface does not prevent the inclusion of such a species in this section.

† This may be a rather unscientific division, but it is in practice an easy way of separating the few species of striking appearance from the more normal ones.

- 4a. Thorax, brownish-yellow ground-colour; dorsum black from anterior to hind margin, leaving humeri, side margins broadly, and scutellum yellow. Scutellum black, middle third (longitudinally) orange. Abdomen orange with transverse black bands, widest at their middles; hind margins of segments with clear-cut pale yellow bands. Legs brownish yellow, middle and hind femora with black parts. Wings yellowish grey ..... *variegatus*, sp. n.
- b. Reddish-orange species; three black contiguous thoracic stripes; scutellum all reddish orange. Abdomen also, a large black median spot on second segment, a smaller one on third; fourth and fifth segments with wide yellowish-white clear-cut hind margins. Legs reddish orange, knees black. Wings grey, nearly basal half rather dark yellowish brown ..... *neavei*, sp. n.
- c. Near *neavei*, but quite distinct. Outer thoracic stripes longer and not contiguous with middle one. Abdomen orange-yellow, black median spots on second, third, and fourth segments; fourth and fifth segments without yellow hind margins. Wings brownish yellow ..... *congoensis*, sp. n.
- d. Thorax dull lemon-yellow, three conspicuous black non-contiguous stripes; scutellum concolorous yellow, with square black mid-basal spot. Abdomen black, with whitish hind margins to segments much widened at their middles. Legs mainly dull lemon-yellow to tips. Wings grey, front part of basal half smoke-brown ..... *distinctus*, sp. n.
5. Abdomen blackish, definite pairs of pale spots on second, third, and fourth segments ..... *8-maculatus*, Brun.
- Abdomen orange-brown, no pale spots; fifth and sixth segments broadly black at base ..... *trilineatus*, sp. n.
6. Legs mainly yellowish; two pale yellowish spots on second abdominal segment... ..... *nyasæ*, sp. n.
- Legs mainly black ..... 7.
7. Wings brownish, darker anteriorly; abdomen darker brown, hind margins of segments narrowly whitish yellow; legs black-brown, tips of femora narrowly yellow ..... *costalis*, Walk.
- Wings hyaline; thorax and abdomen shining black, former with two narrow yellow dorsal stripes, latter with margins of all segments bone-white ..... *lineatus*, sp. n.
8. Abdomen mainly pale, with or without darker markings or pale hind margins to segments... 9.
- Abdomen dark, with pale markings (apart from pale hind margins to segments) ..... 11.
9. Abdomen with only one segment (first) with pale hind margin; no other bands ..... *marginifasciatus*, sp. n.
- Abdomen with second to fifth segments with clear-cut conspicuous yellow hind margins ... 10.
10. Hind corners of thorax, scutellum apically, conspicuously brownish yellow: abdominal segments with broad black spot in middle..... *rufomarginatus*, Brun.
- Hind corners of thorax, and the scutellum, all black: abdominal second segment with large

- black median spot; third with similar smaller spot, rest of abdomen brownish yellow ..... *basalis*, Walk.
11. Conspicuously characteristic species ..... 12.  
Less conspicuous species ..... 14.
12. Hind margins of abdominal segments conspicuously red; venter yellow; legs black, basal half of tibiæ reddish orange ..... *insignis*, sp. n.  
Hind margins of abdominal segments never red. 13.
13. Second, third, and fourth abdominal segments each with a pair of pale yellow conspicuous spots; hind tibiæ not incrassate ..... *sex-maculatus*, sp. n.  
Only one pair of abdominal spots (on second segment); hind tibiæ obviously incrassate ..... *crassitibialis*, sp. n.
14. Abdomen uniformly dark brown; thoracic dorsum and scutellum concolorous; hind margins of segments not pale ..... *fuscus*, Brun.  
Abdomen always with pale hind marginal bands. 15.
- 15a. Humeri, wing-bases (generally), hind corners of dorsum, and the scutellum distinctly brownish yellow. Femora on about basal half brown, rest yellowish; tibiæ distinctly paler; tarsi, at least basally, yellowish ..... *varius*, Latr. (typical).
- b. Humeri and other parts mentioned above, as in *varius*. Femora on basal  $\frac{1}{3}$  to  $\frac{2}{3}$  black, rest yellowish; tibiæ uniformly brownish yellow; tarsi uniformly black. Scutellum with a median black line (type) or basal spot (cotypes). [dimarginalis, nov.
- c. Humeri, wing-bases, hind corners of dorsum, and the scutellum all black, or at most slightly pale \* ..... *varius*, Latr., var. *pallipes*.
16. Wings wholly quite clear from extreme base and costa ..... 16.  
Wings never wholly clear, distinctly yellowish or brownish basally and anteriorly ..... 17.
17. Halteres clubs yellowish ..... 21.  
Halteres clubs black or blackish with tips broadly yellowish or whitish ..... 18.  
Halteres clubs wholly black (sometimes tips narrowly slightly pale) ..... 19.
18. Abdomen moderately dark brown; hind margins of segments pale, sometimes narrowly and well defined, but generally more broadly and less well defined: sometimes greater part of scutellum pale. Legs practically wholly pale yellowish. Wings clear; halteres yellowish. 20.  
Abdomen blackish brown; hind margins broad, bone-white, clear-cut, sometimes filling hinder half of some of the segments. Legs with femora dark chestnut-brown on about basal two-thirds, rest yellow, the colours not sharply defined; remainder of legs yellowish, tarsi tips a little darker. Wings clear; halteres yellowish. *gibbosus*, L.
19. Abdomen dark chestnut-brown, hind margins pale yellowish grey, quite distinct, but not sharply outlined. Abdominal pubescence rather short, yellowish grey. Legs moderately dark brown, femora darker; anterior femora rather broadly yellowish-tipped. Wings clear. [ensis, nov.  
Halteres clubs black, tips whitish ..... *varius*, Latr., var. *siberi-*

This applies only to *castaneus*.

- Abdomen dark nut-brown, hind margins of second and third segments narrowly whitish, of fourth and fifth rather wider. Humeri and hind corners of dorsum yellowish brown. Legs brownish yellow, basal two-thirds of middle, three-fourths of hind femora black (rest of legs missing). Wings clear. Halteres with clubs partly black and partly white.....
- 20 a. Abdomen dark brown to black; hind margins of segments very clear-cut, whitish to yellowish; abdominal pubescence moderately long, erect, whitish grey. Legs brownish yellow, basal half of femora more brownish, extreme base of tibiæ black, tarsi rather darker than tibiæ but uniform. Wings clear. Halteres clubs black .....
- b. Abdomen with ground-colour yellowish brown; wide transverse black bands reaching nearly from front to hind margins of segments in their middles, but narrowing considerably towards their ends (i. e., towards side margins of segments). Hind margins of segments rather widely and clear-cut cream-yellow. Abdominal pubescence long, erect, whitish. Legs brownish yellow; femora more blackish apically than basally, especially on hind pair which have basal half distinctly yellowish brown; tarsi black, basal two-thirds of metatarsi brownish yellow. Wings clear. Halteres clubs black ...
- c. Abdomen dark brown, more yellowish towards tips of third, fourth, and fifth segments; hind margins very narrowly yellowish, not clear-cut; abdominal pubescence quite long, erect, dense, brownish grey (appearing paler in certain lights). Legs brownish yellow, femora not darker basally, tarsi basally of same colour as tibiæ tips. Halteres, stems yellowish, clubs all black.....
21. Abdomen pale chestnut-brown, hind margins of segments whitish, moderately wide but not clear-cut, and bearing numerous minute brown spots. Legs mainly brownish yellow, femora more brownish on basal half or more. Wings a little brownish yellow infuscated broadly at base and on costa \*. Halteres yellowish, clubs brown .....
- Abdomen blackish brown; wings rather deeply yellowish brown, darker basally and anteriorly.
22. Femora black to tips, basal half of tibiæ orange, tarsi black. Abdominal bands pale brownish yellow, relatively narrow.....
- Femora black on basal half to three-fourths, tips pale, more broadly so on upper side; tibiæ black, except narrowly pale at base. Abdominal bands more whitish, relatively broader .
- sorellus*, sp. n.
- zonatus*, Erichs.
- consimilis*, sp. n.
- fratellus*, sp. n.
- castaneus*, sp. n.
- 22.
- [Brun.
- angustimarginalis*,
- victoriensis*, sp. n.

*Oncodes brunneus*, Hutton.

A short series in the British Museum from New Zealand, some

\* The unique type may be somewhat immature.

labelled Wellington, 8. ii. 1911 (*Capt. F. W. Hutton*); Christchurch, Ohakune, v. 1922 (*J. W. Campbell*), others with no closer data.

A further series from New Zealand amongst the unnamed material in the British Museum have nearly or entirely clear wings, and the legs showing much variation, being in individuals entirely and quite black, in others shining brown varying in intensity and extent, in others again with the tibiae all brownish yellow. The data are as follows:—Wilton's Bush, Wellington, 28. xi. 1921; 6. xii. 1920; Karori, Wellington, 28. i. 1917; 16. ii. 1920; Gollans Valley, 24. xii. 1921 (all *G. V. Hudson*). Ohakune, 1922–23 (*T. R. Harris*). The specimen from Gollans Valley has a pale irregularly-shaped spot of some size, but with indefinite outline towards each side margin on the third segment.

*Oncodes rufomarginatus*, Brun.

I have seen further specimens in the British Museum from Nuwara Eliya, Ceylon, captured by Col. Yerbury, 22. v. 1891; 14. vii. 1892.

*Oncodes gibbosus*, L.

Specimens in the Paris Museum from Landes, iv. 1917; Vosges; and Bucharest (*Montandon*); and in the British Museum from the Lower Pyrenees and Germany.

*Oncodes zonatus*, Erichs.

Specimens from various parts of France without exact data in the Paris Museum. One in the Dufour collection from Franzenbad, Bohemia.

*Oncodes pallipes*, Latr.

Well distributed throughout France; no exact data given in a series in the Paris Museum.

*Oncodes variegatus*, sp. n.

*Head.* Vertex shining black; face, antennæ, and lower part of head yellowish brown; occiput blackish.

*Thorax* orange-brown; a broad black stripe from anterior to hind margins, leaving humeri, side margins broadly, and posterior calli orange-brown. Pleuræ all orange-brown except sternopleura wholly, and a black spot here and there. Scutellum black, more than middle third orange-brown. All pubescence of thorax very short, pale yellowish except on median dorsal black stripe, where it is black.

*Abdomen.* Ground-colour bright orange-brown; on each segment a black transverse band, broadest in middle, narrowing towards sides, where it is almost interrupted and widened again into a good-sized squarish spot on each side margin. Hind margin

of each segment with a very clear-cut whitish-yellow rather narrow band. Venter whitish yellow.

*Legs.* Anterior femora and tibiæ mainly brownish yellow, with a rather irregular black line on inner and outer sides of middle pair. Hind femora black, with a small yellowish spot on outer side near tip. Hind tibiæ blackish, with traces of two yellowish bands on outer side, the inner side almost wholly yellowish. Tips of anterior tibiæ very narrowly yellowish. Tarsi blackish, basal joints more or less narrowly yellowish. Pubescence of legs inconspicuous, yellowish.

*Wings* pale brownish yellow, costal cell yellowish brown; veins dark brown; squamæ sordid yellowish grey, with very short whitish pubescence. Halteres, knobs yellowish.

*Length* 5 mm.

Sex unascertainable from the method of mounting. Described from a unique in the British Museum from Townsville, Queensland, 14. vi. 1901 (*F. P. Dodd*). A very striking and handsome species.

This species has a considerable resemblance to *O. basalis*, Walk. The latter species differs materially in the all-black thorax and scutellum, the different abdominal markings, although at first sight they appear very similar, the black basal half of all the femora, and, lastly, the narrowly black front margin towards the sides of the sternites.

*Oncodes neavei*, sp. n.

♂. *Head.* Eyes absolutely contiguous for nearly their entire length from the extremely small vertical triangle, wholly occupied by the raised black ocellar triangle with the three brownish ocelli, to the small black bare frontal triangle, which is slightly prominent towards the sides. Face, antennæ, and lower part of head black, latter with moderately long greyish pubescence. Occiput black, not projecting anywhere beyond eye-margins.

*Thorax.* Dorsum bright orange-brown; a broad median black stripe from anterior margin nearly to hind margin, with a contiguous similar shorter stripe each side extending from about level with wing-base to hind margin of dorsum. Pleuræ wholly black; scutellum bright orange-brown. Whole thorax, pleuræ, and scutellum with dense, moderately long, yellowish pubescence, which is a little more greyish on pleuræ; metanotum shining black.

*Abdomen* bright orange-brown: first segment shining black; second and third each with a large central oblong black spot, transversely placed, that on second segment reaching from anterior to posterior margin, that on third segment falling short of hind margin, except at the middle; fourth segment with a round black spot at base. A small black spot at extreme sides of second segment, and a much larger oblong one, similarly placed, on sides of third, fourth, and fifth segments, the latter spots joined together by a narrow hind marginal black band. Remainder of segments more or less black in parts. Hind margins of second and third

segments narrowly whitish yellow; fourth and fifth segments with a very much broader similar band which is narrowed towards sides. Venter with first segment long, orange-brown, broadly black at sides, remainder of venter whitish yellow, segments narrowly black at base, the colour broadening a little towards sides. Genitalia shining black, yellowish in parts.

*Legs.* Coxæ, trochanters, base of femora narrowly, knees and front tarsi black; remainder of legs bright orange-brown [tarsi, except fore pair, mostly missing]. Pubescence of legs inconspicuous, yellowish.

*Wings.* Costa blackish; basal half of wing brown, anterior part of this much deeper than posterior part; apical half of wing nearly clear. Thoracal squamæ yellowish grey, with greyish pubescence and black margins. Halteres black.

*Length* 8 mm.

A unique ♂. Southern edge of Kakamega Forest, Yala River, British East Africa, 4800–5300 ft., 21–28. v. 1911 (*Dr. S. A. Neave*).

A very striking species through the contrast of body-colours and the brown basal half of the wing.

*Oncodes congoensis*, sp. n.

Allied to *neavei* in general appearance.

The differences in the *head* are as follows. Occiput distinctly, though not greatly, projecting behind eyes in profile: frons with a median longitudinal furrow, which adds to the effect of the actually prominent sides, the latter raised distinctly above level of eyes. First antennal joint almost sunk in the head, black, with a microscopical narrow white rim; second dull orange-brown, very short, annular (third joint missing). Proboscis broken off. Rest of head as in *neavei*.

The *thorax* differs from *neavei* by the outer stripes beginning sooner and not being quite contiguous with the middle stripe. Pleuræ dark brown, with irregular paler parts; scutellum large and prominent. Pubescence of thorax, scutellum, and pleuræ short, moderately dense. Rest of thorax as in *neavei*.

*Abdomen* (description) orange-yellow: first very short segment black, with narrow pale yellow hind margin; second with large irregularly square black spot in middle, from base nearly to hind margin; third with a squarish black basal spot reaching to about middle of segment; fourth and fifth each with a very small black triangular spot in middle of front margin. On extreme side margins of second, third, and fourth segments a triangular black spot, a smaller irregular one on fifth segment. Venter wholly orange-yellow, indistinct irregular black marks towards sides.

*Legs* all orange-yellow, except coxæ and trochanters dark brown, extreme base of tibiæ with shining dark brown spot, also four last tarsal joints dark brown; (middle legs missing).

*Wings* distinctly brownish yellow, extreme tips barely lighter; squamæ blackish, black-margined; halteres yellowish.

*Length* 6 mm.

One specimen, Belgian Congo (*Don Gilson*). Unique type in Belgian Congo Museum, Brussels.

The head and thorax of *congoensis* are differentiated in the above from *neavei*, the rest of the description is not comparative.

*Oncodes distinctus*, sp. n.

? ♀. *Head*. Eyes very closely contiguous for nearly their full length. Vertical triangle black, fully occupied by the ocelli and some long yellowish hair. Frontal triangle black, small, smooth, flush with eyes. Antennæ blackish, with a little grey dust; lower part of head and occiput black; latter with a little greyish pubescence and narrow grey-dusted margin.

*Thorax*. Dorsum bright yellow. Three moderately broad black stripes; median one reaching from front to hind margin, a little narrowed behind; on each side of it, and nearly contiguous, a shorter stripe of equal width, pointed at each end, reaching from a little behind humerus to hind margin of dorsum. Humeral region (except the yellow humeri themselves) black, with a central yellowish spot. Pleuræ mainly black, with a horizontal yellowish stripe along their middle, united to an indefinitely outlined yellowish space behind wing-base. Scutellum yellow; a broad median black stripe from base nearly to hind margin. Underside of scutellum black; metanotum yellow. Pubescence of thorax wholly yellowish, moderately long and dense.

*Abdomen* black; first segment narrowly whitish yellow on hind margin; second and third segments with a squarish yellowish spot each side of median line on hind margins, well separated; the hind margins also whitish yellow; fourth segment without spots, but hind margin similarly pale, though interrupted in the middle line, at which point the band is much broader; fifth segment with broad hind marginal uninterrupted band, narrowing towards sides; sixth segment yellowish at tip. Genitalia concealed; sex apparently ♀.

*Legs* bright orange-yellow; middle coxæ basally, hind coxæ entirely black. Pubescence of legs negligible, pale yellowish.

*Wings* yellowish grey; about basal half brownish anteriorly. Thoracal squamæ brownish; margins black, well defined; surface pubescence and fringe yellowish. Halteres brownish yellow.

*Length* 6 mm.

Kenya Mica Co. (locality illegible), 6. v. 1911, "on grasses" (*Dr. S. A. Neave*).

*Oncodes trilineatus*, sp. n.

*Head*. Vertical triangle small, black, practically flush with eyes; two dull brown inconspicuous ocelli. Eyes bare, closely contiguous to the small triangular blackish frons. Antennæ rather



dark brown, first joint short, rather indefinite; second broad, short; third elongate, slender, with long, apical, style-like arista ending in a microscopic bristle. Underside of head broad. Occiput not projecting beyond hind margin of eyes.

*Thorax* dull orange-brown, with three moderately broad, well-separated, black stripes, the middle one from anterior margin to beyond middle of dorsum, the outer ones from in front of wing-bases to hind corners of dorsum. A vertical black stripe on pleuræ just behind shoulders, a small one just below wing-base, an indefinite black patch above front coxæ and another behind it. Scutellum uniformly orange-brown. Pubescence of whole thorax short, brownish yellow.

*Abdomen* orange-brown, fifth and sixth segments broadly black at base: genitalia black. Pubescence of abdomen dark brown basally, but becoming yellowish, short, and inconspicuous towards tip. Venter apparently yellowish (concealed and partly damaged).

*Legs.* Coxæ and femora black; tibiæ and metatarsi brownish yellow, rest of tarsi black.

*Wings* brownish, a little darker anteriorly and in stigmatic region. Squamæ and halteres dull yellowish; former with narrow dark brown rims and short pale fringe.

*Length* 8 mm., wing 7 mm., expanse about 16–17 mm.

One specimen, Lambarène, Ogooué, Gold Coast, 1913 (*Ellenberger*). Paris Museum.

*Oncodes nyasæ*, sp. n.

? ♂. *Head* wholly black; eyes closely contiguous for nearly their full length; vertical triangle and lower part of head with a little greyish pubescence.

*Thorax* light yellowish brown, approaching chestnut; a median black, moderately broad stripe from anterior nearly to hind margin, with a rather broader, distinctly shorter, and nearly contiguous stripe each side of it, reaching to hind margin. A blackish indefinite spot behind humerus, extending over greater part of mesopleura, with a smaller spot below it. A blackish space below hind corners of dorsum. Scutellum shining black; sides with a trace of paleness; underside yellowish, metanotum black.

*Abdomen* blackish: hind margins of segments more or less narrowly yellowish; a large pair of ill-defined yellowish spots on second segment, a little smaller and better-defined pair on third segment, and a still smaller and indefinite pair on fourth segment; all well separated and well clear of side margins. Venter yellowish, with darker shadings. Pubescence of abdomen dark brown, moderately long and dense, uniform. Genitalia comprising apparently a thin, long, horny penis, with other parts.

*Legs* brownish yellow; coxæ, outer side of anterior tibiæ, and hinder side of hind pair, also all tarsi, brownish.

*Wings* pale brownish grey. Thoracal squamæ obscurely yel-

lowish brown, with black margins and pale pubescence and fringe. Halteres yellow, clubs black.

*Length* about 5 mm.

Mt. Mlanje, Nyasaland, 23. viii. 1913 (*Dr. S. A. Neave*), type (? ♂). In a second specimen from the Tero Forest, S.E. Buddu, 3800 ft., Uganda Protectorate, 26-30. ix. 1911 (*Dr. S. A. Neave*), the abdominal spots are only indistinctly visible.

*Oncodes costalis*, Walk.

Walker's type is from India and not now in good condition (at British Museum). Ocellar tubercle black, well raised; ocelli brownish. Antennæ pale yellowish; occiput black. Thorax is best described as brownish yellow with three broad blackish stripes, median one from anterior margin of thorax, the others shorter, all reaching hind margin of thorax where they appear to be united. Propleuræ and mesopleuræ dark brown, shining. Abdomen dark brown, hind margins of segments with narrow, clear-cut, whitish-yellow bands. Venter yellowish with irregular small black marks. Legs shining dark brown; fore coxæ wholly, tips of posterior pairs and tips of all femora pale yellow. Wings quite clear, a little brownish down to third vein; squamæ obscurely grey, margins darker, fringe whitish. Halteres brown.

*Length* nearly 4 mm.

*Oncodes basalis*, Walk.

The type in the British Museum, from New South Wales (ex Saunders' coll.), is in good condition and bears a striking resemblance to my *rufomarginatus* from Ceylon, the differences being as follows.

Hind corners of thorax and the scutellum wholly black; hind tibiæ all orange; second abdominal segment (the first being extremely short and easily overlooked) all black, except the conspicuous whitish hind margin; ground-colour of rest of abdomen brownish yellow; third segment with a very large median black spot extending over the white hind margin; fourth segment with a similar black spot not encroaching on hind margin; fifth and sixth segments without black markings in median line.

*Length* nearly 5 mm.

In *rufomarginatus* the black median spots occur on all the segments and are more strictly transverse bands extending across more than half the width of the segment. In *basalis* the black colour in the anterior femora only covers the basal half and on the hind legs reaches a little further, the colour in all the legs ending abruptly. In *rufomarginatus* the black extends beyond the middle in the anterior legs and to still further in the hind pair, and ends on all legs indistinctly.

*Oncodes lineatus*, sp. n.

♂. *Head*. Lower part and occiput grey; vertex black, with short black pubescence; antennæ apparently yellowish.

*Thorax* shining black, with short yellow pubescence; a pair of well-separated, orange-yellow, very narrow stripes on dorsum, enlarged at anterior ends, which just fail to attain front margin, but extend to hind margin; a small oval orange-yellow spot towards side margins in front of wing-base: humeri conspicuously pale yellow; a very narrow pale line extending from them to hind corners of dorsum which are rather broadly pale yellow: scutellum shining black, with brownish-yellow pubescence: pleura shining black with a little pale pubescence, but broadly yellowish white below wing-base.

*Abdomen* shining black, second segment with rather a dark brown tinge; hind margins of all segments bone-white; belly apparently similar to upper side. Pubescence of abdomen pale yellowish, sparse.

*Legs*. Coxæ black, whitish in front; front legs mainly yellowish brown, knees broadly paler; posterior legs blackish brown, tips of femora broadly and base of tibiæ narrowly yellowish. Pubescence of legs black.

*Wings* clear; costa, first, second, and extreme base of third vein quite black; rest of venation as faint as usual; squamæ conspicuously blackish, a little iridescent; the very short pubescence pale; halteres dirty white.

Described from a single ♂ from Tura, Garo Hills, Assam, 1200–1500 ft., 15. vi.–15. vii. 1917 (*Kemp*).

Type in Indian Museum.

The specimen is apparently a male, but from the mounting the antennæ and genital organs are not clearly visible. It is a conspicuous species through the distinct pale lines on the thorax and abdomen.

*Oncodes marginifasciatus*, sp. n.

*Head*. Vertical triangle small, wholly occupied by the small raised black ocellar tubercle with two ocelli. Eyes closely contiguous down to the blackish frons. Antennæ brownish yellow. Underside of head blackish. Occiput not projecting behind eyes in profile.

*Thorax* (discoloured) apparently black; pleuræ and scutellum similar, traces of a little short pale pubescence.

*Abdomen* pale yellowish brown. First segment very short, black, with extremely narrow yellowish-white hind margin; second to fifth segment at sides with a black spot on front margin of each, extending hindwards to the side border nearly to hind margin of segment, the inner side of the spot narrowing till it dies away. Scutellum small, black.

*Legs*. Coxæ black, remainder bright yellow, pubescence colorous, inconspicuous.

*Wings* quite clear, veins pale yellowish; squamæ obscurely yellowish, margins dark brown; halteres yellowish.

*Length* 6 mm., wing 4 mm., expanse about 10 mm.

One specimen, Solan, India, 1897 (*R. Oberthür*). Paris Museum.

*Oncodes insignis*, sp. n.

♂. *Head*. Vertex shining black; face grey-dusted; antennæ blackish, arista brownish yellow; two small yellow transverse marks just above fore coxæ; occiput black.

*Thorax* shining black, yellowish-grey depressed pubescence; hind inner corners of humeri bright brownish yellow, slightly drawn out into a small obtuse point; posterior calli elongate, well developed, bright brownish yellow; scutellum black with yellowish-grey pubescence, whitish behind. Pleuræ black, reddish yellow about wing-base, a little grey pubescence.

*Abdomen* shining black, with fine, short, rather erect, brownish-grey to whitish pubescence. First segment very short, all black; second and rest with a broadly bright yellowish-red, very clear-cut, hind marginal band on each; second segment with a small spot of same colour at the extreme sides. Venter pale yellow, black at base, traces of black at bases of some of the hinder segments.

*Legs* shining black; tips of fore coxæ narrowly and basal half of all tibiæ bright yellow red. Pubescence of legs yellowish.

*Wings* quite colourless, anterior veins yellowish; squamæ blackish in front, paler towards the brownish-yellow margins, with grey pubescence on disc. Halteres, stems yellow-red, clubs grey-brown.

*Length* 5 mm.

Described from a unique ♂ in the British Museum. Kalamunda, S.W. Australia (*Mrs. R. H. Reade*).

A very striking species by the red abdominal bands and bases of tibiæ.

*Oncodes sex-maculatus*, sp. n.

♂. *Head* black; eye-facets small, uniform in size; antennæ black, normal.

*Thorax* shining black, with short yellowish-brown pubescence; scutellum similar.

*Abdomen* dull black or barely shining; on second, third, and fourth segments a pair of very large elongate-oval brownish-yellow spots, occupying nearly all the surface, leaving hind margin narrowly pale yellow, widest on fourth segment; fifth and sixth segments black, with yellow hind margin which is scarcely obvious on sixth segment. Pubescence of abdomen short, moderately dense, black, apparently shorter on pale parts. Genitalia apparently small, concealed.

*Legs*. Coxæ and nearly apical half of femora, tips of tibiæ narrowly, and tarsi mostly, black; remainder brownish yellow; metatarsi mainly brownish yellow. Legs microscopically pubescent.

*Wings* with normal venation, blackish grey; stigmatic region a little darker; costal cell dull yellowish; squamæ considerably blackish.

*Length* fully 4 mm.

Described from a unique ♂ in the Indian Museum sent by Mrs. Annie Drake, bred from a small spider at Serampore, near Calcutta, 23. i. 1920.

The species bears considerable resemblance to my *8-maculatus* on account of the large, oblong, pale abdominal spots, but the shining black thorax, the black on the legs, and the larger size will readily distinguish it.

*Oncodes crassitibialis*, sp. n.

♂. *Head*. Eyes closely contiguous for nearly their whole length; vertical triangle black, with rather short black hairs; ocelli dark; remainder of head blackish; mouth-border apparently greyish. Occiput nearly flush with eyes, black.

*Thorax*. Dorsum shining black, with normal yellowish pubescence; humeri and hind corners pale yellowish; on inner sides of humeri a small rather bright brown spot. Pleuræ black, brownish yellow about base of wing. Scutellum shining black; metanotum obscurely yellowish.

*Abdomen* black; hind borders of segments narrowly whitish yellow; second segment with a pair of widely separated, elongate, longitudinally placed, similarly coloured spots reaching from front to hind margin. Venter as dorsum, but without spots on second segment. Pubescence of abdomen black-brown. Genitalia black, of moderate size, with paler markings.

*Legs* mainly brownish yellow; coxæ more or less, a streak on upper side of femora, knees, outer side broadly of hind tibiæ, and all the tarsi blackish brown. Hind tibiæ conspicuously incrassate from just beyond base to tips.

*Wings* brownish grey, anterior margin a little darker. Thoracal squamæ obscurely brownish, margins black; pubescence pale. Halteres yellow, clubs black.

*Length* 5 mm.

One ♂, near Langenbury, East Africa, x. 1917 (*Chas. H. S.*).

A species conspicuous from all others by the striking incrassation of the hind tibiæ.

*Oncodes varius*, Latr.

Two specimens in the British Museum from Sz-Fejervár, Hungary (*Thalhammer*).

*Oncodes varius*, Latr., var. *pallidimarginalis*, nov.

*Head* blackish; eyes closely contiguous for nearly their entire length; vertex with yellowish-brown hair; frontal triangle grey-dusted; occiput black, with a little greyish pubescence.

*Thorax.* Dorsum shining black; humeri, base of wing and hind corners, also scutellum, brownish yellow; latter with a small black spot in middle. Pleuræ brownish yellow; underside of thorax black. Pubescence of whole thorax yellowish, of normal length and density.

*Abdomen* black; hind margins of all segments rather narrowly whitish yellow. Venter yellowish or whitish yellow, segments narrowly black at base.

*Legs.* Coxæ and about three-fourths of femora, also all tarsi, black; remainder of legs brownish yellow; pubescence of legs pale.

*Wings* brownish grey, a little darker below costal cell and along veins. Thoracal squamæ brownish to dirty white, with pale hairs and margins barely darker. Halteres blackish, tips of clubs yellowish.

*Length* 8 mm.

Nandi Plateau, British East Africa, 5700–6200 ft., 30. v.–4. vi. 1911 (*Dr. S. A. Neave*), type; two other specimens 5 mm. long, Nasisi Hills, 20 miles N. of Mumias, British East Africa, 4800 ft., 14, 15. vi. 1911 (*Dr. S. A. Neave*). One specimen in the Belgian Congo Museum from N'Gwese, Lac Kivu Cheff, Belgian Congo (*Carlier*), shows a slight variation, the base of the scutellum being black, leaving a broad yellowish margin from side to side, the wings being no darker anteriorly but uniformly yellowish grey, and the squamæ blackish, with distinct black margin. It is 4 mm. long.

In spite of the difference in size between the type and the other specimens, there seems no doubt of the specific identity of them all.

*Oncodes varius*, Latr., var. *siberiensis*, nov.

This variety is sufficiently described in the table of species. The whole thorax and scutellum are black, and the abdomen and legs darker brown than usual. One specimen only, Jakutsk, Siberia, 1–7. vi. 1900. In the British Museum.

*Oncodes sorellus*, sp. n.

Very like *victoriensis* in general appearance, but apparently distinct. Pubescence of thoracic dorsum more erect, and longer; squamæ more whitish grey, middle tibiæ with apical third yellowish; wings almost hyaline, but anterior veins as distinct as usual. At least the upper pair of transverse whitish-yellow spots above the front coxæ are visible, and it may be a variety only, but the wide difference of locality suggests specific distinctness.

*Length* 4 mm.

One specimen, Howick, Natal (*J. P. Cregoe*). In the British Museum.

*Oncodes consimilis*, sp. n.

Considerably like *O. basalis*, Walk. The pubescence of the thorax is more yellowish, that of the abdomen is distinctly longer,

rather conspicuously whitish, the clear-cut yellow hind margins of the segments being quite bare (as is the case also in *basalis*). The first and second abdominal segments are all black, the third, fourth, fifth, and sixth mainly blackish brown on more than the basal half of each, the remaining portion paling to a bright yellowish brown; the black spots at the sides of the segments are less clearly demarcated, larger, more triangular, and almost united to the blackish-brown basal band. The femora are much more slender in form, brownish yellow, indistinctly darker distally; the tibiæ brownish yellow, the tarsi mainly black but first joint brownish yellow on basal half or more.

*Length* 6 mm.

A single specimen from Mount Ruapelui, New Zealand, 4000 ft., Jan. 1922 (*G. V. Hudson*).

Unique type in British Museum.

Apart from the first and second abdominal segments, which are wholly black in both species (except for the whitish hind margin of second segment in each), the ground-colour of the rest of the abdomen in *consimilis* is blackish brown, shading into brownish yellow posteriorly; but in *basalis* it is bright brownish yellow, with the black spots clearly cut on third and fourth segments. In the type of *basalis* the pubescence of the thorax and abdomen is more yellowish, that of the abdomen much shorter than in *consimilis*; the black in the femora is on the basal half only and sharply defined, the femora themselves stouter and more uniformly cylindrical; the tibiæ uniformly bright orange and the tarsi wholly black from base to tip. The wings in *consimilis* are absolutely colourless and the squamæ nearly as clear, although not actually transparent; in *basalis* the wings are yellowish grey, the squamæ obscurely whitish.

*Oncodes fratellus*, sp. n.

♂, ? ♀. This species bears a general resemblance to *victoriensis*, but is clearly distinct by the absence of the yellowish spots above the fore coxæ\*.

Vertex rather more prominent, shining black, antennæ sometimes paler brown. Humeri black; transverse whitish calli-like spots on prothorax reduced or absent. Pubescence of thorax conspicuously longer and somewhat more erect, varying from blackish brown to brownish yellow. Abdomen more or less brown on apical segments, especially in type; pale hind marginal bands more yellowish or brownish, but decidedly narrower, practically absent on some segments, especially on first and second. Abdominal pubescence more white, much longer, and erect. Venter black, hind margins of segments narrowly brownish yellow. Legs from pale yellowish brown to yellowish; tarsi darker towards tips, extreme base of tibiæ sometimes shining black. Wings absolutely clear, including base and costal cell, venation (for this genus) very distinct; squamæ whitish, pubescence white, rims black-brown.

\* In one specimen a single pair of much smaller similar spots are visible.

*Length*  $3\frac{1}{2}$  to 6 mm., the latter specimen the type; its wing about  $3\frac{1}{2}$  mm., with expanse about 9 mm. (estimated).

Described from five specimens from Beaconsfield, Victoria, of which three, including type ♂ and presumed ♀, are dated 8. xii. 1923 (*G. F. Hill*), all agreeing closely.

The three principal specific characters are the much longer pubescence, the yellowish legs, and the quite clear wings; the smaller size seems also characteristic. The single presumed ♀ is on the same pin as one of the cotype ♂ ♂.

*Oncodes castaneus*, sp. n.

? ♀. *Head*. Vertex black, with a little short black pubescence; face blackish viewed from below, grey-dusted viewed from above; antennæ black, third joint very shining, arista long, brownish yellow. Eyes widely separated on lower part of head; occiput grey-dusted, with long yellow hairs on lower part.

*Thorax* very dark shining brown; side margins, humeri, and posterior calli more yellowish; scutellum concolorous with dorsum. Pleuræ paler yellowish brown, darker in parts and on sternopleuræ. Pubescence of whole thorax yellowish, short, depressed.

*Abdomen* light chestnut-brown; hind margins of all segments, including first very short one, with moderately wide, dirty-white, not very clearly demarcated bands, mottled with minute brown dots. Venter brown with whitish hind margins to segments, and the whole surface more or less irregularly marked with whitish.

*Legs* light chestnut-brown, tips of femora broadly and of tibiæ very narrowly brownish yellow. Pubescence of legs very short, yellowish.

*Wings* very pale brownish yellow, nearly clear, a little darker along subcostal cell. Squamæ whitish grey, with short greyish pubescence and yellow-brown margins. Halteres (apparently) yellowish, knobs brown.

*Length* nearly 6 mm.

Described from one apparent ♀ in the British Museum. South Queensland (*Dr. T. L. Bancroft*). It is just possible the type is somewhat immature, in which case the colour of the abdomen and to some extent the legs may be in matured specimens as dark as the thorax.

*Oncodes victoriensis*, sp. n.

*Head*. Vertical triangle of moderate size, black, nearly flush with eyes; ocelli not very distinct. Eyes closely contiguous down to the moderately large frontal blackish triangle, nearly flush with eyes. Antennæ rather dark brown, last joint elongate conical, drawn out into a long apical aristiform style. Face and mouth-region whitish yellow, with comparatively long pale pubescence. Occiput nearly flat, barely projecting behind eyes, some blackish-brown hair on upper part.

*Thorax* shining black or black-brown, region round wing-base



more brownish; dorsum and scutellum with slightly depressed brownish-yellow or yellowish pubescence; humeri pale brownish yellow; mesopleura swollen; pubescence of pleuræ concolorous with that of dorsum. Two yellowish-white calli-like spots placed transversely one above the other (but just separated) immediately above each fore coxa.

*Abdomen* shining black or black-brown, oval in shape, much broader than thorax at its widest part (third and fourth segments); segments about subequally long except the narrow first and the last one, which latter is about half as long as the fifth. Hind margin of all segments narrowly yellowish, sometimes interrupted in middle, the width of the colour varying slightly in individuals, but usually of uniform width except just appreciably broader in middle on third, fourth, and fifth segments. Pubescence as on thorax, very short and depressed. Venter mainly yellowish, with darker parts and very short pale pubescence.

*Legs.* Femora and tibiæ mainly shining black or dark brown, tips of former and bases of latter more or less broadly yellowish; tarsi dark brown, pulvilli yellowish, claws black.

*Wings* brownish grey, darker basally and anteriorly, and along the principal veins darker still. Squamæ dirty white, rims dark brown, pubescence short, whitish; halteres yellowish, clubs black.

*Length* 4 to 8 mm.; wing (of largest specimen) 9 mm.; expanse about 22 mm.

Described from eight specimens sent by the Victoria Museum, Victoria, Australia. Warburton District (type), Frankston, Glunovwom (?), all Victoria; Nanaheim, New South Wales. The latter specimen has paler legs and is in bad condition and probably immature, but apparently conspecific. A ninth specimen amongst unnamed material in the British Museum is probably *victoriensis* also, from Townsville, Queensland, 14. vi. 1901 (*F. P. Dodd*).

Type in British Museum.

? *Villalus chilensis*, Cole.

A specimen in the Paris Museum may be this species or an undescribed closely allied one. The second and third veins separate exactly at the anterior cross-vein; the latter vein occupying the same position as in *chilensis*. The antennæ are at about one-fourth the distance above the middle (of the head in profile) to the vertex. No proboscis is visible (the head being somewhat crushed on the thorax), but very distinct large palpi are present, thick, club-shaped, pubescent, and concolorous in colour with lower part of head. The abdomen is somewhat crumpled, a little longer than the thorax, approximately conical. The points of resemblance are the venation, the antennæ, and the uniform orange-brown or tawny colour of the whole body and the pubescence. The legs are a little paler, more yellowish, and the abdomen a little more reddish.

One specimen from Cusco, Peru, labelled "Gay, 59-49." Paris Museum.

## BIBLIOGRAPHICAL NOTICE.

*Bird Study in India.* By M. R. M. HOLMER, M.A.  
Second edition. Pp. 143.

IN this little work Miss Holmer has given us a second edition of a very readable stepping-stone, as she calls it, between popular and scientific ornithology. Her attempt has been to write a book which should enable visitors and others in India to identify the birds they see, and then, having identified them, to go a step further, and to attempt to place them in a small classification. The title of the book would presume that it applies equally to all birds of India, but Miss Holmer herself admits that the birds she knows are those of the North-west, many of which, however, are equally common practically throughout the Peninsula.

Her descriptions of the birds about which she writes are brief, yet very much to the point—for instance, no one who reads her description of the little white scavenger vulture on page 31 could possibly fail to recognize it. Beautiful as this bird is in flight, she describes well its “tiny brainless-looking head, greedy eye, and cruel beak, its plumage always dishevelled.” In some cases, perhaps, her generalizations may mislead—as, for instance, when she says, in describing the ducks as a class, that if the drakes are like the ducks they are probably not ducks at all, but geese. Had she thought a little she would have realized that the difference between the sexes in some of our Indian ducks and teal is but very small. We rather wonder what the huge reed-warbler is which is so common round Lahore and Amritsar: we confess that we have not yet met with it.

In regard to the more scientific aspect of the book, it is, perhaps, unfair to be closely critical, but it is a pity that the author goes quite so much into detail in some instances: thus, in the swifts the character of the toes varies in almost every genus, yet she gives as the one identification mark “the toes all forwardly directed and weak.” She might also, perhaps, have been a little more careful in remembering that when one speaks of families the termination of the word should be “-idæ,” not “-inæ,” which refers to subfamilies only.

In spite, however, of these small faults which one can discern amongst the mass of good, Miss Holmer's little book will probably prove not only the most useful, but also the most interesting, of the several guides which have recently been published with a view to assisting in the identification of our common Indian birds.

The illustrations are in keeping with the letterpress—modest, yet quite effective. The book has been brought up to date, and Miss Holmer, in her enthusiasm for the bird in the field, seldom ignores the need for scientific accuracy.

## PROCEEDINGS OF LEARNED SOCIETIES.

## GEOLOGICAL SOCIETY.

May 5th, 1926.—Dr. F. A. Bather, M.A., F.R.S.,  
President, in the Chair.

The following communication was read :—

‘The Geology of the Country between Drygarn and Aber-gwesyn (Breconshire).’ By Kenneth Arthur Davies, M.Sc. (Communicated by Prof. W. J. Pugh, O.B.E., M.A., F.G.S.)

The area dealt with includes about 20 square miles of country. It is situated 5 miles north of Llanwrtyd Wells, and about 3 or 4 miles south-west of the Rhayader district. The area has not previously been described in detail.

The rocks belong to the Bala and to the Valentian Series, but the latter only is described in detail. It is considered that the Valentian rocks rest conformably upon the Bala.

The sediments are generally of the mudstone-and-shale type, with subsidiary bands of grit and conglomerate. A full graptolitic succession in the Valentian rocks has been proved, from the basal zone of *Glyptograptus persculptus* to Gala Beds with *Monograptus turriculatus*, *M. runcinatus*, and *M. exiguus*, etc. *Cephalograptus cometa* has not been found, although it is very probable that the horizon is that of the flaggy mudstones with abundant *Petalograptus minor*, etc. In the northern part of the area, there is a conspicuous conglomeratic band (the Drygarn Conglomerate) about 250 feet thick, which lies within the zone of *Monograptus atavus*.

The area lies on the western flank of the Towy Anticlinorium, but the strata are folded into a subsidiary syncline (the Gwesyn Syncline) and anticline (the Rhiwnant Anticline), with their axes parallel to that of the main structure: that is, from south-west to north-east. Faulting is practically restricted to the southern side of the Gwesyn Syncline, where for some distance an important strike-fault separates the Birkhill from the Bala rocks. The rocks are highly cleaved, the strike of the cleavage-planes being approximately parallel to the strike of the strata.

The succession is compared with those described at Rhayader<sup>1</sup> and Plynlimon.<sup>2</sup> The conglomerates (Caban Goch) of Rhayader do not appear in this area, nor is there any indication of an unconformity at the base of the *Monograptus-sedgwicki* Zone, which is so characteristic a feature of the neighbouring country. The total thickness of the Birkhill rocks is similar to that of the Rhayader country, but much greater than at Plynlimon. A noticeable feature is the greater thickness of the Birkhill rocks on the north-western, than on the south-eastern, side of the area.

<sup>1</sup> H. Lapworth, Q. J. G. S. vol. lvi (1900) p. 67.

<sup>2</sup> O. T. Jones, *ibid.* vol. lxx (1909) p. 463.

THE ANNALS  
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LXX.—*On some new Mites of the Suborder Prostigmata (Trombidiidea) \**. By STANLEY HIRST.

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[Plates XXIII.–XXV.]

THE mites described below probably all are predaceous free-living forms when adult. The larval stage of the Trombidiidæ and Erythræidæ is known to be parasitic, with the possible exception of one or two species in the latter family. Some of the larvæ of the Trombidiidæ attach themselves to vertebrates, others to invertebrates. A number of these larval Trombidiid mites attack mammals, including Man, and these are popularly called "Harvest Bugs." The larvæ of the Erythræidæ, however, apparently only attach themselves to arthropod hosts. Our knowledge of the mites belonging to these two families is still very incomplete, and much research both into their life-history and taxonomy is still necessary. Many of these mites are only known from descriptions of the larval stage, the adults not yet having been recognized.

\* The illustrations in this paper are all camera-lucida drawings prepared under my supervision. Miss Violet Borrow has prepared the text-figure, also figs. c, e, f, g, i, j, k, l on Pl. XXIII., a & c on Pl. XXIV., and all Pl. XXV. except fig. f. Miss Hopkins has drawn figs. a, b, d, h on Pl. XXIII., fig. b on Pl. XXIV., and fig. f on Pl. XXV.

*Ann. & Mag. N. Hist.* Ser. 9. Vol. xviii. 41

## Family Trombidiidæ.

*Allothrombium socotranum*, sp. n.

(Pl. XXIII. figs. a, d, k.)

♀.—*Ocular tubercle* rather short and stout; pedicel short. *Dorsum* with numerous very short plumose setæ or hairs, and also less numerous larger plumose setæ, the latter almost club-shaped, being very densely plumose distally. Shorter setæ relatively more numerous than in *A. terræreginæ*, sp. n. None of these setæ are septate. When examined under considerable magnification the *integument* is seen to be ornamented with exceedingly minute polygonal markings, subequal in size and each containing a minute circle or oval appearance. *Tarsus* of *first leg* three times as long as high; metatarsus of this leg a little shorter than the tarsus. Hairy *pulvillus* well developed, especially on posterior tarsi.

*Length* of body (of mounted specimen probably slightly pressed) 3.7 mm.

*Hab.* Socotra.

*Allothrombium terræreginæ*, sp. n.

(Pl. XXIII. figs. b, c, l.)

♀.—*Ocular tubercle* short and fairly stout; pedicel short. Hairs on *dorsum* of two distinct types as in *A. socotranum*, viz., short plumose hairs which are much less numerous than is the case in *A. socotranum*, and much larger hairs with enlarged densely plumose distal ends, these longer hairs being relatively more numerous than in *A. socotranum*. None of these hairs are septate. Microscopical sculpturing of dorsal *integument* very like that of *A. socotranum*, but the little oval appearances vary more in size, some being much larger than others. *Palp* as usual without any accessory spines or thorns near the main claw, and lacking the club-shaped hairs shown by Canestrini on the palp of his *Ottonia phyllophorum*, very fine but plumose hairs being present. *Tarsus* of *first leg* almost  $2\frac{1}{2}$  times as long as its height; metatarsus of this leg a little shorter than the tarsus. Hairs on *legs* short plumose and quite fine but rather stiff. Hairy *pulvillus* well developed, especially that of the posterior legs.

*Length* of body 3.8 mm. Another smaller specimen, probably a male, measures 2.8 mm.

*Hab.* Eidswoold, Queensland. Three specimens collected by Dr. T. L. Bancroft in 1913 (Moltano Institute Collection).

## MESOTHROMBIIUM, subgen. nov.

Hairy *pulvillus* of tarsi well developed as in *Allothrombium*. Longer *body-hairs* with their distal ends slightly and rather gradually enlarged (but not knob-like as in *Sericothrombium*). Shorter *body-hairs* are also present on the dorsum. *Palp* with terminal claw only, accessory spines and *thorus* being absent. *Eyes* with distinct *pedicel*.

*Allothrombium (Mesothrombium) antipodianum*, sp. n.

(Pl. XXIII. figs. e, g, h.)

♀.—*Ocular tubercle* slightly more slender than in the variety *olorinum* (from Swan River, Western Australia). Besides the longer *body-hairs* mentioned above (especially noticeable at the sides and posterior margin of the body) there are shorter hairs, some of which bear a close resemblance to the long hairs, having slightly enlarged ends. All are plumose, but there are some short hairs of another type which have the extreme tip of the distal end strongly chitinated, naked, and sharply pointed instead of being enlarged; these pointed hairs or setæ are often arranged in definite spots or patches on the dorsum. Apparently only the central strip of the *crista* is darkened and strongly chitinated, being rather like that of *Sericothrombium*. *Palpal thumb* (tarsus) club-shaped. *First tarsus* about  $2\frac{1}{2}$  times as long as its height; *metatarsus* of this leg shorter than the *tarsus*.

*Length* of body 5.4 mm., its width 2.75 mm.

*Hab.* Tjaljijum, Tweed River, New South Wales, Sept. 1912. Two specimens found under stones in the jungle; ex N. C. Rothschild's Coll. A specimen in spirit has been selected as type.

*Allothrombium (Mesothrombium) antipodianum*, var. *olorinum*, nov. (Pl. XXIII. figs. f, i, j.)

♀.—Longer *body-hairs* very similar to those of the typical form, but slightly thicker and more densely plumose, the tip being more distinctly enlarged, some of the posterior hairs almost knob-shaped distally. *Crista* with the anterior median plate fairly distinct and rather like that of *Trombidium* (s. s.), and the posterior strip-like portion apparently not so long as in the typical form. *Pedicel* bearing the eyes stouter, being scarcely narrowed at the base. *Palpal thumb* (tarsus) more slender and the end less swollen. The little ventral projection of the *palpal claw* indistinct. *Tarsus* of first leg twice and a half as long as its height.

*Length* of body about 5.0 mm.

*Hab.* Swan River, Western Australia.

## Family Erythræidæ.

## NEOSMARIS, gen. nov.

*Dorsal suture* between the main parts of the dorsum apparently absent. A pair of *eyes* on each side anteriorly, and these two pairs are not very widely separated. *Crista* consisting of two *sensiligerous areas*, but the usual longitudinal connecting-line of chitin is absent. *Surface* of body smooth, lacking ornamentation. *Palp* with five free segments including the tarsus (thumb). *Legs* with fine hairs and setæ only.

*Neosmaris novæzealandiæ*, sp. n. (Pl. XXIV. figs. a-c.)

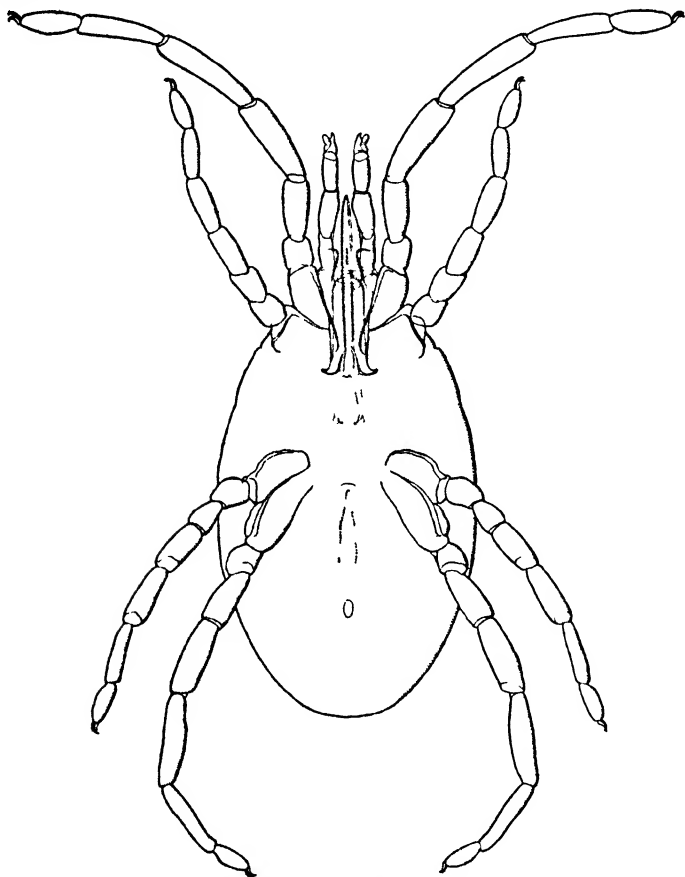
♀.—*Body* (mounted specimens probably somewhat pressed) oval, but not much longer than wide. Pairs of *eyes* not very widely separated, in this respect resembling the eyes of *Fessonia prominens* as figured by Banks. *Cephalothoracic part* of body scarcely narrowed, however—the median process present in *Fessonia prominens* being absent. *Sensiligerous areas* small but distinct, the anterior one bears a pair of fine, rather long, pseudostigmal hairs and also a number of radiating setæ which are almost straight, being stouter than the other hairs on the dorsum, and also differ from them in being slightly but distinctly plumose. *Surface* of body lacking the ornamentation present in *Smaris*. *Body-hairs* numerous, cylindrical, rather short, and usually nude, accessory hairlets being absent or difficult to see; they are not enlarged distally. *Chelicerae* protrusible, being long and styliform. *Palpal thumb* (tarsus) rather short, fairly stout, and furnished with numerous curved hairs. *Claw* of palp very short. *Legs* long, the fourth pair being the longest. First tarsus more than twice as long as high; metatarsus of this leg considerably longer than the tarsus. Claws of legs plain, being devoid of teeth. Most of the hairs on the legs are nude, but there are a few distinctly feathered hairs at the distal end of the metatarsi. Tarsi also with scopulæ of feathered hairs. None of the hairs on the limbs are club-shaped or flattened.

*Length* of body 2·4 mm.; greatest width (behind last pair of legs, specimen probably slightly pressed) 2 mm.

*Hab.* Routeburn, Otago, New Zealand. Two specimens from this locality.

## MICROSMARIS, gen. nov.

Allied to *Neosmaris*, gen. nov., but not very closely. *Size* minute. *Integument* soft and devoid of ornamentation. Both *sensiligerous areas* of the *crista* are present and connected by a narrow, rather obsolete, weakly chitinized, longitudinal strip of integument. A single *eye* on each side of the dorsum anteriorly. Body and legs with fine unmodified hairs only.



*Microsmaris mirandus*, gen. et sp. n., ♀.  
Ventral view (all hairs omitted).

*Microsmaris mirandus*, sp. n.  
(Pl. XXV. figs. a, f, g, and text-fig.)

♀.—*Body* moderately elongated and not very wide, not being quite twice as long as wide. *Cephalothoracic area*



indicated by a distinct groove laterally (indistinct dorsally?). A single *eye* on each side. *Sensiligerous areas* of the *crista* not well-defined, and they each bear a pair of fine nude pseudostigmal hairs; these two sensiligerous areas are connected by an ill-defined, chitinous, longitudinal strip devoid of hairs; just behind the posterior sensiligerous area this longitudinal strip becomes wider and more distinct. The rest of the dorsum furnished with numerous, short, nude, fairly stiff hairs or setæ, which are usually slightly curved. A little in front of the middle of the length of the dorsum there is a little eye-like structure on each side of the body, widely separated from that on the opposite side. These eye-like structures are circular in outline and consist of a lens-like appearance in the centre, surrounded by a rim or ring of flattened racket-shaped hairs. Near the posterior end of the body there is another pair of these eye-like structures, but they are placed closer together. Only the anterior part of the tracheal system situated near the internal part of the chelicerae seems to be present in this mite (in this feature it resembles *Smaris*, *Neosmaris*, etc.). *Palp* of the normal Erythræid type, the tarsus thumb-shaped and moderately elongated, bearing numerous hairs. Penultimate segment with the usual curved claw. *Legs* fairly long and slender, the first leg the longest, being a little shorter than the body. *Claws* of legs small and without denticles. *Scopulæ* of tarsi poorly developed. Hairs on legs nude and fine, but fairly stiff.

*Measurements* (in mm.).—Length of body .94 mm., its width .50 mm. Length of first leg (incl. trochanter) .89 mm.

*Hab.* Near Christchurch, New Zealand. Two specimens collected by J. W. Campbell, Esq.

#### Family Cryptognathidæ.

*Cryptognathus australiensis*, sp. n. (Pl. XXV. figs. b–e.)

♀.—*Colour* dark red (in spirit). *Body* oval and narrowed anteriorly. *Hood* distinct and with pit-like depressions. *Dorsum* with numerous exceedingly fine punctations, but without any distinct scale-like markings. There seems to be a slight marginal rim with longitudinal striations. A little behind the hood there is a pair of eyes on each side of the dorsum, the anterior eye being convex, the posterior larger but much flatter and not well defined. There are also three pairs of short oblique lines or crevices, possibly sensory in nature, on the surface of the dorsum, the first is situated laterally a little behind the eyes, the second a little

behind the middle of the body, the third not far from the posterior end of the dorsum. Punctations on *venter* more elongated than on the dorsum, many of them being in the form of very short striæ. *Anus* terminal. *Genital opening* situated at the posterior end of the venter occupying the position in which the anus is found in most mites. *Body-hairs* very few in number, and they are very short, fine, and inconspicuous. *Capitulum* elongated and protrusible; it consists of a delicate collar-like portion bearing the base of the capitulum from which the palps arise, and also includes the elongated *chelicerae*, the latter terminating in short smooth (?) fingers. *Tarsus of palp* bearing about five stiff, curved, blunt, rod-like setæ and also one or two hairs. *Legs*: first tarsus with a pair of well-developed conical tubercles situated side by side on the highest part of the dorsal surface of the segment and each bearing a stiff hair. Second tarsus with a single dorsal tubercle bearing a stiff hair. Another stiff, rod-like, somewhat curved seta, which is blunt at the end, is also present more proximally both on the first and second tarsi. Posterior tarsi without any dorsal tubercles, and with very fine hairs only. Each tarsus of the legs with about twelve tenent hairs of the same type as in *Tetranychus* and its allies.

*Length* of body 300  $\mu$ .

*Hab.* Two specimens from pine-trees (*Pinus canariensis*), Kuitpo Forest, about thirty miles from Adelaide, South Australia (F. G. Holdaway).

NOTE.—It is interesting to find a species of the genus *Cryptognathus* occurring in Australia. Hitherto only one species of the family (*Cryptognathus lagenæ*, Kramer) was known to science. Owing to the generosity of Miss George, of Kirton-in-Lindsey, who has presented the valuable collection of mites made by her father to the British Museum, I have been able to study *C. lagenæ* and compare it with the new species.

## EXPLANATION OF THE PLATES.

### PLATE XXIII.

- Fig. a.* *Allothrombium socotranum*, sp. n. First metatarsus and tarsus.  
*Fig. b.* *Allothrombium terræ-reginæ*, sp. n. First metatarsus and tarsus.  
*Fig. c.* Ditto. End of palp.  
*Fig. d.* *Allothrombium socotranum*. End of palp.  
*Fig. e.* *Allothrombium* (*Mesothrombium*) *antipodianum*. First metatarsus and tarsus.  
*Fig. f.* *Allothrombium* (*Mesothrombium*) *antipodianum*, var. *olorinum*, nov. First metatarsus and tarsus.

*Fig. g. Allothrombium (Mesothrombium) antipodianum.* Lateral body-hairs.

*Fig. h. Ditto.* End of palp.

*Fig. i. Ditto (var. olorum).* End of palp.

*Fig. j. Ditto (var. olorum).* Crista and eyes.

*Fig. k. Allothrombium socotranum.* Group of body-hairs on dorsum.

*Fig. l. Allothrombium terræ-reginæ.* Group of body-hairs.

#### PLATE XXIV.

*Neosmaris novæzealandiæ*, gen. et sp. n.

*Fig. a.* Ventral view of female (hairs omitted).

*Fig. b.* Crista and eyes.

*Fig. c.* End of palp.

#### PLATE XXV.

*Fig. a. Microsmaris mirandus*, gen. et sp. n. Dorsal aspect (hairs mostly omitted).

*Fig. b. Cryptognathus australiensis*, sp. n. Palp.

*Fig. c. Ditto.* Tarsus of first leg, greatly enlarged.

*Fig. d. Ditto.* Hood.

*Fig. e. Ditto.* Lateral view of body and legs.

*Fig. f. Microsmaris mirandus.* Anterior part of dorsum showing eyes and crista.

*Fig. g. Ditto.* Ventral view of end of palp.

LXXI.—*Scalpellum sanchezi*, sp. n., a Cirripede from the Lower Miocene of Cuba. By THOMAS H. WITHERS, F.G.S.

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[Plate XXVI.]

DR. MARIO SANCHEZ ROIG, of Habana, Cuba, has recently collected in the Lower Miocene Marls of that island three specimens exhibiting Cirripede remains. At the instance of Dr. C. T. Trechmann, F.G.S., these three specimens were sent by Dr. Sanchez Roig to me for determination, and he most generously said that they could be retained for the British Museum Collection.

Careful clearing away of the somewhat soft creamy-yellow marl has resulted in exposing in one specimen (Pl. XXVI. fig. 1) part of a single capitulum, and in another (Pl. XXVI. figs. 3, 4) remains of two capitula. A third specimen (Pl. XXVI. fig. 6) exhibits a good carina with incomplete tergum and scutum. Altogether the valves include the carina, paired scuta and terga, representatives of four pairs of latera, a rostrum, and some comparatively large peduncle-plates. The species, therefore, had at least fourteen valves

in the capitulum. An additional valve, the subcarina, may have been present, but there is no evidence for it.

Such complete material as this is most unusual among fossil stalked Cirripedes, for the species are generally represented merely by disconnected valves. In this instance the remains must have been covered up before the valves could become scattered, for some of the valves are in their natural position, and others are not far removed from each other. From these remains it is possible to give a restoration of the capitulum.

There is no doubt that the fossils represent a species belonging to the subgenus *Arcoscalpellum* of the genus *Scalpellum*. This subgenus embraces a group of almost exclusively deep-sea species, and has a range from Lower Cretaceous (Aptian) to Recent. The early forms of *Arcoscalpellum* have fifteen valves, but the Recent species have in some cases lost the subcarina as well as the rostrum, and there is a tendency towards a reduction of the inframedian latera and the eventual development of an eleven-valved capitulum. The present fossils cannot be referred to any species so far known and is therefore here described as new; it is the first fossil Cirripede to be described from Cuba. The trivial name is in honour of Dr. Mario Sanchez Roig, who is doing such good service to Cuban palæontology.

*Scalpellum (Arcoscalpellum) sanchezi*, sp. n.

**Diagnosis.** An *Arcoscalpellum* with carinal latus wider than high and having a recurved umbo. Carina strongly convex transversely, with narrow sides. Rostrum triangular. Rostral latus with the inner extremity narrow and rounded. Inframedian latus low and wide. Peduncle-scales low and wide.

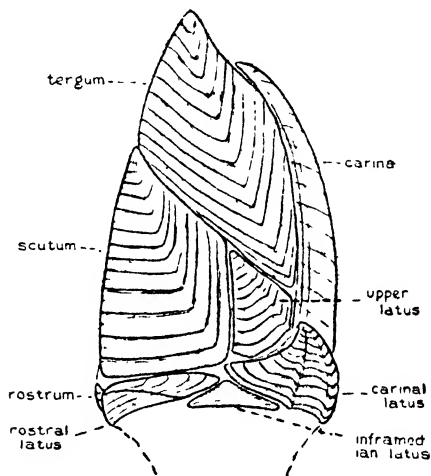
**Holotype.** The specimen with part of a single capitulum (In. 25996, Pl. XXVI. fig. 1).

**Distribution.** Lower Miocene, "Barro" Marl; Tejar Con-suelo, Cerro, Habana, Cuba.

**Material.**—In. 25996 (Pl. XXVI. fig. 1) represents the remains of a single individual, and comprises a right scutum in natural position with the paired terga, an upper latus out of position and resting on the scutum, an inframedian latus below the base of the scutum, a peduncle-scale, and a right carinal latus displaced from its original position, the rostral angle of the valve only being discernible in a front view. An enlarged view of the carinal latus is represented by Pl. XXVI. fig. 2.

In. 25997 (Pl. XXVI. figs. 3, 4) represents the remains of two individuals with the valves all displaced from their original positions; the valves preserved include carinæ (basal halves of two valves), scuta, terga, upper latera, rostral latera, inframedian latera, carinal latera, a rostrum, and peduncle-scales. Enlarged views of the rostrum and rostral latus are represented by Pl. XXVI. fig. 5. Fragments of marl were broken in transit from these two specimens, and these contained a left carinal latus (In. 25998), an inframedian latus (In. 25999), and two peduncle-scales (In. 26000-1).

In. 26002 (Pl. XXVI. fig. 6) represents a carina with the lower part of a tergum and the inner side of part of a scutum.



*Scalpellum (Arcoscalpellum) sanchezi*, sp. n.  
Restoration of capitulum.

*Description.*—Valves comparatively thick, their surface almost smooth, but with low ribs formed at each period of growth.

Carina with narrow sides, bowed inwards, the basal margin V-shaped, the two sides forming an angle of from 110-120°. Tectum strongly convex transversely, subcarinate, bordered on each side by a slight, low, rounded ridge, which is much less marked on the lower half of the valve. Parietes narrow, about one-sixth the width of the tectum, slightly concave, splayed outwards in the lower half of the valve, and marked off from the intraparietes by

a slight rounded ridge. Intraparietes narrow, abruptly bent inwards, and fill up solidly the upper part of the valve, the inner margin almost flat. Transverse sections of the carina are represented by Pl. XXVI. figs. 7 *a*, *b*.

Scutum trapezoidal, breadth more than two-thirds the length, with a slight apico-basal ridge, the low ribs terminating each period of growth being almost regularly spaced. Occludent margin moderately convex, forming less than a right angle with the basal margin. Basal margin slightly convex, almost straight, forming with the lateral margin rather more than a right angle; basilateral angle slightly rounded. Tergal margin slightly concave, the tergo-lateral angle moderately rounded and situated in a line from more than one-third to one-half the length of the valve.

Tergum subtriangular, elongate, width about half the length, with a slight low curved apico-basal ridge, situated more than one-third the width of the valve from the carinal margin. A slight ridge or fold extends from the apex to the scutal margin, about one-third the width of the valve from the apico-basal ridge, and is followed by a wide low depression to the occludent margin. Carinal margin not distinctly divided into two parts, the upper part short, concave, about half the length of the convex lower part; occludent margin convex, about two-thirds the length of the slightly convex scutal margin. Upper part of valve slightly curved away from the scutum.

Upper latus triangular, erect, umbo apical. Scutal margin slightly concave. Tergal margin slightly convex. Basal margin generally strongly convex, but, owing to the wide truncation of the basi-tergal angle of the valve and the narrow truncation of the basi-scutal angle, the margin is flattened at its sides. Two obscure ridges or folds extend from the apex, and mark on the basal margin the extent of the truncated angles.

Rostral latus more than three times as wide as high, with a strong rounded ridge extending from the umbo to the lower part of the rounded lateral end. Upper margin slightly convex; lower margin strongly concave at its rostral end, which is obliquely truncated.

Inframedian latus obtusely triangular, low and wide, with the umbo apical. Basal margin longer than the carino-lateral margin, and the carino-lateral margin nearly twice as long as the rostro-lateral margin.

Carinal latus triangular, wider than high, the umbo apical, apex incurved, and a prominent ridge extends from the apex to the lower margin, marking the extent of the

adjoining inframedian latus. A more conspicuous ridge extends from the apex close and parallel to the carinal margin; along the carinal margin the growth-ridges are strongly raised and curved upwards. Upper margin strongly concave, forming a low rounded ridge; carinal margin strongly convex; basi-lateral margin sigmoidally curved, slightly produced below the median ridge.

Rostrum small, triangular, almost smooth, strongly convex transversely, the lateral margins convex slightly, and the basal margin convex at the sides and concave in the middle third.

Peduncle-plates flat, smooth, very low and wide, downturned at the sides, the upper margin convex but flattened in the middle, and the lower margin strongly concave. Largest plate almost half the width of the scutum.

*Measurements.* Length of capitulum of holotype about 40 mm.; scutum, length 20·5 mm., breadth 13 mm.; tergum, length 25 mm., breadth 13 mm. Carina (slightly incomplete), length 32 mm., breadth (greatest) 9·5 mm. Largest peduncle-plate, breadth 6·2 mm., height 1·0 mm.

*Comparison with other Species.* Of the Arcoscalpellids from the New Zealand Tertiaries (Withers, 1924, N.Z. Geol. Surv., Palæont. Bull. No. 10), the present species resembles most closely the species *S. (A.) complanatum*, but is distinguished at once by the strong transverse convexity of the carina. *S. (A.) sanchezi* differs still more from the Italian Tertiary species *Scalpellum michelottianum*, Seguenza.

*S. (A.) sanchezi* resembles certain of the recent species belonging to the group of *S. (A.) velutinum*, Hoek (Pilsbry, 1907, p. 26), and, indeed, may be an ancestor of those forms. This group contains some of the largest species of the genus. The valves of *S. (A.) sanchezi* generally resemble those of *S. regium* and its varieties, but the carinal and inframedian latus are not so high in relation to their breadth, the inner extremity of the rostral latus is narrower and more rounded, and the tectum of the carina is not flat-roofed or even slightly arched, but is strongly convex. The form of the carina is more like that of *S. giganteum*, Gruvel, but the sides are much narrower, and the remaining valves differ markedly.

#### EXPLANATION OF PLATE XXVI.

*Scalpellum (Arcoscalpellum) sanchezi*, sp. n.

Fig. 1. Capitulum (incomplete), showing right side. Holotype.  
× 1·5 diam. Brit. Mus., In. 25996.

Fig. 2. Carinal latus from other side of above specimen. × 3 diam.

- Fig. 3. Associated valves evidently representing two capitula.  $\times 1.5$  diam. Brit. Mus., In. 25097.  
 Fig. 4. Other side of same.  
 Fig. 5. Rostrum and rostral latus from same.  $\times 3$  diam.  
 Fig. 6. Carina with incomplete tergum, and part of scutum showing inner side.  $\times 1.5$  diam. Brit. Mus., In. 26002.  
 Fig. 7. Transverse sections of carina. *a*, about middle of valve,  $\times 2$  diam.; *b*, short distance from apex,  $\times 4$  diam.

LXXII.—*Descriptions and Records of Bees.*—CXIII.

By T. D. A. COCKERELL, University of Colorado.

Callomelecta, gen. nov.

General appearance *Anthophora*-like, with long hair on thorax. Abdomen without conspicuous markings; scutellum with a pair of stout sharp spines; pygidial plate obtuse; venation similar to that of *Melecta*, but marginal cell with its rounded end extending far beyond third cubital (in the manner of *Ericrocis*); second cubital cell very narrow above, third very broad; first recurrent nervure joining second cubital cell at beginning of its last third; in hind wing the submedian cell is more remote from discoidal than in *Melecta* (a character of *Bombomelecta*); mandibles simple, with an obtuse inner angle; tongue going very little beyond labial palpi; paraglossæ slender, strap-like, half the length of first joint of labial palpi; second joint of labial palpi hardly a third length of first joint; last two joints small; maxillary palpi very long and slender, six-jointed, the first and last joints shortest; hyaline area of maxillary blade narrow.

Type the following species. This is the most primitive of the known Melectines, and is very close to the North American *Bombomelecta*, differing by the much larger marginal cell.

*Callomelecta pendleburyi*, sp. n.

♀.—Length about 12 mm.

Black, the thorax densely covered with fox-red hair, very bright above; antennæ ordinary, dark, second joint very short; clypeus closely punctured, with shining anterior margin; antenniferous tubercles red, finely punctured; frons, cheeks, and vertex with red hair; tegulæ ferruginous.



Wings dilute fuliginous, not very dark. Legs black, with pale reddish hair. Abdomen broad, shining black, the first three segments laterally with very pale reddish hair, and this extends thinly all over first segment, which is itself obscurely reddish; venter with pale hair. The following approximate measurements of the palpi are in microns:—labial palpi, joints (1) 1600, (2) 480, (3) 95, (4) 125; maxillary palpi, joints (1) 95, (2) 190, (3) 190, (4) 205, (5) 175, (6) 105.

Bukit Kutu, Selangor, Malay Peninsula, April 19, 1926 (*H. M. Pendlebury*).

"It was flying along a laterite bank, examining all the holes and crevices." It is presumably parasitic in nests of *Anthophora*. Its general appearance is exactly that of the American *Bombomelecta fulvida*, Cresson.

*Anthidium tenuifloræ yukonense*, subsp. n.

♂ (type).—Scape entirely black (or with a small light spot); upper part of clypeus with two large cuneiform black marks (or these absent); lateral face-marks squarely transversely truncate above; eyes dark (not at all green); hair of thorax white (not yellowish); light mark on tegulæ much smaller; first abdominal segment entirely black; marks on the other segments reduced, slender, second segment with only small lateral marks (or with also sublateral dots); sixth segment entirely black (or with a pair of curved light spots); lateral apical lobes broad.

♀.—Abdominal markings more slender, on first segment reduced to a spot at each extreme side; sixth segment entirely black. Ventral scopa entirely pale.

Carcross, Yukon Territory, Aug. 1926, 2 ♂, 1 ♀ (*Wilmatte P. Cockerell*).

A well-defined northern race. It is somewhat approached by a specimen from Calgary (*Miss Ricardo*) in the British Museum (see 'Canadian Entomologist,' 1912, p. 293).

*Anthidium palliventre*, Cresson.

Carmel, California, Aug. 12, 1926 (*Cockerell*).

3 ♂; hair of thorax above varying from white to pale tawny.

*Cælixys mæsta*, Cresson.

Carcross, Yukon Territory, Aug. (*W. P. Cockerell*).

2 ♂, agreeing with a Colorado specimen from Cresson's collection. The spurs are red, not black as Sladen describes.

*Megachile nivalis*, Friese.

Carcross, Yukon Territory, Aug., 1 ♀, and White Horse, Y.T., Aug., 2 ♀ (*W. P. Cockerell*).

Previously known from the Canadian Zone in Colorado. It is very like *M. relativa*, but has the ventralscopa black at end (one or two segments), the abdominal bands pure white, and the last dorsal segment without any pale hair. From *M. mendica*, Cresson, it is known by the closely punctured clypeus.

*Megachile relativa*, Cresson.

Carcross, Yukon Territory, Aug., 1 ♀ (*W. P. Cockerell*) ; near Ukiah, California, at flowers of *Clematis* in the gulch below Mr. Purdy's garden, July 17, 1926, 2 ♂ (*Cockerell*).

The males agree with what I have considered *M. relativa* from Boulder, Colorado ; a slender form with simple anterior tarsi, strongly spined anterior coxæ, yellow hair on face, sixth abdominal segment with dense white hair above. Robertson long ago stated that the anterior coxæ of male *M. relativa* were unarmed, but this refers to *M. infragilis*, Cresson, which was then confused with *M. relativa*. The male of *M. relativa* is very like that of *M. mendica*, Cresson, but hair of vertex not dark and abdomen narrower.

*Megachile (Oligotropus) angelarum*, Cockerell.

Petrified Forest, California, July 10, 1926, 1 ♂, 1 ♀ (*Cockerell*).

*Hylæus verticalis* (Cresson).

Carcross, Yukon Territory, Aug., 3 ♀ (*W. P. Cockerell*).

These agree with Lovell's account of female *H. verticalis*, and are presumably that species. The wings are strongly dusky ; tegulæ all black or reddened posteriorly ; tubercles light, but collar dark ; mesothorax very finely and densely punctured ; pleura finely punctured ; hind tibiæ with basal third or fourth creamy-white ; lateral face-marks slender, pale yellow. On the other hand, I do not find anything tangible to separate these females from those of the Siberian *H. cardioscapus*, Ckll. The male of *H. cardioscapus* shows that it is distinct from *H. verticalis*, but the two are closely allied, and the females may well look alike.

*Augochlora pomoniella*, Cockerell.

Avalon, Catalina Island, Aug. 1926, 2 ♀ (*Cockerell*).  
New to Catalina ; described from the mainland.

*Melissodes timberlakei*, sp. n.

♀.—Length 11 mm.

Robust, black, the tarsi obscure reddish apically, spurs pale ferruginous ; mandibles with a broad orange streak ; antennæ black, obscurely reddened beneath, especially toward end ; tegulæ black, but with pale hair. Wings grey, with dark nervures. Eyes (dry) pale lilac ; maxillary palpi very small ; facial quadrangle broader than long, but not very broad ; clypeus densely punctured. Head with dull whitish hair, black on vertex and ochreous on occiput ; thorax with white hair beneath, above with pale ochreous, with large patches of black on posterior part of mesothorax (not reaching tegulæ) and scutellum. Legs with mainly creamy-white hair, ferruginous on inner side of middle and hind tarsi ; anterior tarsi with black hair on outer side and red on inner. Abdomen broad, with dense pale ochreous hair-bands, a basal one on second segment, broad discal ones on second and third, and fourth entirely covered with hair so far as visible ; last two segments with black hair, large white tufts at extreme sides.

Citrus Experiment Station, Riverside, California, August 1926 (*Timberlake and Cockerell*).

I name this after Mr. P. H. Timberlake of the Citrus Station, whose work on bees, if I may judge by his unpublished MSS., is likely to prove the most expert yet done in this country.

In my tables this runs to *M. trifasciata*, Cress., from Cuba, and *M. helenæ*, Ckll., from New Mexico, but is known from both by the pattern of the abdomen. Except for the fulvous hair on front of thorax, it runs to *M. gilensis*, Ckll., which is really closely allied. From *M. gilensis* it is known by the smaller size, narrower face, colour of eyes, hind margin of first abdominal segment not broadly pallid, wings grey instead of brownish, etc.

*Melissodes moorei*, sp. n.

♀.—Length about 12 mm.

Robust, black, including tegulæ and antennæ, but a large orange patch on mandibles. Eyes dark, not greenish.

Head broad, facial quadrangle considerably broader than long; clypeus covered with hair; hair of face, cheeks, and occiput dull creamy whitish, of labrum pale sooty, of vertex black; thorax with long pale yellowish hair, fulvous in front above, the mesothorax and scutellum each with a very large patch of pure black, the first patch very narrowly or hardly separated from second. Wings hyaline, very faintly greyish, with dark nervures; spurs light ferruginous. Legs with black hair, except on femora and anterior tibiæ behind, where it is white with a creamy tint; hind knee-tuft black; first abdominal segment with long creamy-white hair, except a patch on each side posteriorly, where it is thin and black; second segment with pale hair at extreme base and a narrow band across disc, interrupted in middle; third segment with a band like that on second, but complete; fourth with much black hair and a pale band near margin; apical segments with black hair; apical plate small.

Sand-hills at Pacific Grove, California, July 3, 1926 (*Cockerell and A. Russell Moore*).

Named after Dr. Moore, the well-known physiologist, who collected bees with me on the sand-hills. In my tables this runs near *M. obliqua*, Say, but is smaller, with light hair on femora, etc. It is perhaps nearer to *M. coloradensis*, Cress., but has much lighter wings, dark flagellum, etc. The two parts of the band on second segment are distinctly oblique, not directly transverse as in *M. confusiformis*, Ckll. This obliquity of the bands is seen in *M. confusiformis incondita*, Ckll., but this has extremely broad pale bands on third and fourth segments.

*Tetralonia pomonæ*, Cockerell.

♂.—Near Yuba City, California, Aug. 1926 (*Cockerell*).

Differs from type in having the pubescence more fulvous, strongly so on thorax above.

*Stelis crassiceps*, sp. n.

♂.—Length nearly 6 mm.

Black, with thin dull white hair; face all black, clypeus convex, shining, closely punctured; tegulæ black; apical half of wings tinged with brownish. Abdomen with white markings; first three segments with successively longer tadpole-shaped marks at sides, that on first a rounded patch with claw-like inner extension; fourth and fifth segments with broad narrowly interrupted bands, emarginate at each side posteriorly; sixth segment with two white spots. The head is unusually large and broad.

Boulder, Colorado, May 31, 1926 (*Eleen Denning*).

Later found by Mr. Chas. H. Hicks to be parasitic on *Alcidamea*. Differs from *S. birkmanni*, Ckll., by the duller, more closely punctured, and differently marked abdomen. The head is very much larger and broader than in *S. sex-maculata*, Ashm.

*Halictus pavonotus*, Cockerell.

Both sexes on sand-hills, Pacific Grove, California, July 3 (*Cockerell and Moore*).

The males have the flagellum dark.

*Agapostemon californicus*, Crawford.

Both sexes at Pacific Grove, California, July 4 (*Cockerell*).

The female resembles *A. radiatus*, Say, but is more robust, with dark tegulæ and much finer sculpture on metathorax above. The hair on legs and abdomen does not materially differ. Crawford's female from Idaho appears to be different.

*Agapostemon texanus*, Cresson.

Davis, California, many females at flowers of lettuce (*Henry A. Jones*).

*Nomioides variegata* (Olivier).

♀.—Limassol, Cyprus, 4. vii. 24 (*G. A. Mavromoustakis*, 2).

The abdominal bands are creamy-white, not distinctly yellow as in specimens from Trieste (*Ducke*).

*Colletes arenicola*, sp. n.

♀.—Length nearly 9 mm.

Black, including antennæ, tegulæ, tarsi, and mandibles, or the last with slightly rufous apex. Head broad, malar space short, fully twice as broad as long; labrum polished, the pits or depressions shallow; clypeus shining, densely and coarsely striate-punctate, with no distinct median sulcus; mesothorax shining, closely punctured, but disc posteriorly with a large polished space almost without punctures; basal area of metathorax, above the transverse ridge, narrow and with strong cross-ridges; mesopleura shining and very densely punctured; hair of head and thorax long,

creamy-white beneath, pale yellowish above, no dark hairs intermixed. Legs with dull white hair. Abdomen highly polished, minutely punctured, with dense white hair-bands on hind margins of first four segments, and fifth covered with creamy-white tomentum. Wings clear.

Sand-hills at Pacific Grove, California, July 3, 1926, 2 ♀ (*Cockerell and Moore*).

The orange pollen collected evidently comes from a species of Compositæ. This species has no spines on the anterior coxæ, and in Robertson's table of Illinois species runs to *C. eulophi*, Rob., from which it is easily known by the black tegulæ, piceous stigma, and more feebly punctured first abdominal segment. The colour of dorsal thoracic hair is exactly the same. The densely punctured clypeus at once distinguishes it from *C. salicicola*, Ckll. The bands on the third and fourth abdominal segments are broader than in *C. algarobice*, Ckll.

*Xenoglossa angelica*, Cockerell.

Rivera, California, at flowers of *Cucurbita fœtidissima*, August 1926 (*Cockerell*).

*Ceratina submaritima*, Cockerell.

♀.—Near Ukiah, California, in Mr. Purdy's garden and in gulch below, at flowers of *Clematis*, July 17 (*Cockerell*).

Variable in size.

*Ceratina nanula*, Cockerell.

♀.—Sand-hills at Pacific Grove, California, July 3 (*Cockerell and Moore*).

The light tubercles will distinguish this from *C. acantha*, Provancher. At the same place we took males of *Hylæus maritimus*, Bridwell.

*Hylæus conspicuus* (Metz).

Mountsville, California, July 10, 1926, at umbelliferous flowers, 2 ♀ (*Cockerell*).

This is identical with the female described by me in 'Entomologist,' 1898, p. 219, and considered with doubt to belong to *H. bakeri* (Ckll.).

LXXIII.—*Some new Genera and Species of Phycitinæ (Pyralidæ) in the British Museum.* By Sir GEORGE F. HAMPSON, Bart.

*Homæosoma stenotea*, sp. n.

Head and thorax fuscous mixed with white, the antennæ fuscous; abdomen white with diffused fuscous bands on each segment; pectus and legs white and fuscous mixed. Fore wing grey-white tinged with fuscous and irrorated with black, the costal edge black towards base; a rather diffused white fascia just below costa to beyond middle; diffused blackish antemedial spots on median nervure and vein 1, usually with some reddish brown between and below them; two black discoidal points, sometimes conjoined; an indistinct oblique blackish subterminal line. Hind wing semihyaline whitish, tinged with fuscous brown; a slight dark terminal line; cilia white with a brownish line near base.

Ab. 1. Fore wing with the white subcostal fascia obsolete.

The antennæ of male have a slight notch at base of shaft.

*Hab.* MASHONALAND, Salisbury (*Marshall*), 1 ♀; TRANSVAAL, White R. (*Cooke*), 1 ♀, Reitfontein (*Janse*), 1 ♀, Pretoria (*Distant, Janse*), 2 ♀; BASUTOLAND, Maseru (*Crawshay*), 1 ♂ type; CAPE COLONY, Zuurberg (*Bairstow*), 1 ♂, Annshaw (*Miss F. Barrett*), 1 ♂, 2 ♀. *Exp.* 16–20 mm.

*Trachypteryx heterogramma*, sp. n.

♀. Head and thorax pale brown-pink with some white on vertex of head and dorsum of tegulæ and thorax; abdomen white mixed with brown and with a small basal crest of brown-pink scales; pectus and legs brown-pink. Fore wing pale brown-pink; the basal area with deep chocolate-brown streak below the cell and above vein 1, the former defined by a white streak below, the latter by white streaks both above and below; a small wedge-shaped chocolate-brown antemedial mark in the cell with an oblique white bar on its outer edge; two very oblique deep chocolate-brown lines from costa before middle to submedian fold well beyond middle; subterminal line very irregular, deep chocolate-brown, very oblique and defined on outer side towards costa, acutely angled inwards above vein 6, then outwards on vein 6, then inwards to beyond upper angle of cell, then outwards as acute teeth on veins 5 to 6 with white streaks above the teeth extending to termen, some deep brown-pink beyond it at apex; some dark scales on terminal half of

inner area; a black terminal line with a silvery-white line on its inner side. Hind wing semihyaline white with a rather diffuse fuscous-brown terminal line and line near base of cilia.

*Hab.* TRANSVAAL, Pretoria (*Janse*), 1 ♀ type. *Exp.* 28 mm.

*Trachypteryx rhodoxantha*, sp. n.

♀. Head ochreous slightly tinged with red, the antennæ ochreous brown; thorax rose-red; abdomen ochreous white with a slight rose-red basal crest; pectus, legs, and ventral surface of abdomen ochreous suffused with red. Fore wing rose-red, the costa and terminal half of inner margin ochreous tinged with red; an oblique white band tinged with yellow from below costa before middle to vein 1, on which it emits a streak towards termen; a similar band from middle of costa to vein 2, on which it emits a streak to termen; cilia yellow with a white line at base. Hind wing semihyaline white, the termen ochreous except towards tornus.

*Hab.* TRANSVAAL, Shilouvane (*Junot*), 1 ♀ type. *Exp.* 22 mm.

*Trachypteryx albisecta*, sp. n.

♂. Head and thorax dark brown tinged with grey, the vertex of head, except the small tuft of scales behind, and the dorsum of tegula white, the antennæ blackish, the palpi red-brown and blackish with some whitish towards base; abdomen pale red-brown mixed with whitish and with two small black-brown crests at base; pectus, legs, and ventral surface of abdomen white mixed with red-brown and black-brown, the tibiæ banded with black-brown, the tarsi black-brown ringed with white. Fore wing dark brown glossed with grey, the basal and terminal areas except at costa suffused with rufous; black streaks on base below costa and cell and a short subbasal streak above inner margin, the two latter with white marks at their extremities; a black band with sinuous edges from below costa to inner margin before the medial line, which is rufous defined on each side by black towards costa, then by dark brown, obliquely curved and slightly waved; two indistinct blackish discoidal points with an oblique white fascia from them to the costa at the subterminal line, which is white defined on inner side by black and slightly incurved at discal and submedian folds; two blackish spots on apical part of terminal area, a fine black terminal line and white line at base of cilia. Hind wing pale reddish brown with a dark



terminal line ; cilia whitish tinged with red-brown and with a dark line near base.

*Hab.* TRANSVAAL, Nkwaleni (*Janse*), 2 ♂ type, Pretoria. *Exp.* 24 mm.

*Endolasia transvaalica*, sp. n. \*

Head and thorax brown mixed with grey, especially on vertex of head and dorsum of thorax, the antennæ blackish, the palpi with a black band at base of 2nd joint ; abdomen red-brown with whitish segmental bands ; pectus, legs, and ventral surface of abdomen dark brown and whitish, the tarsi black-brown ringed with white. Fore wing grey tinged with reddish brown and slightly irrorated with blackish ; a rather sinuous red-brown medial band defined at sides by whitish lines with ridges of raised black scales before and beyond it except on costal area ; and with some black-brown beyond it from costa to lower angle of cell ; subterminal line black defined on outer side by whitish and with the area before it whitish on costal half, slightly dentate and angled inwards at discal and submedian folds, an oblique blackish shade beyond it from costa ; a terminal series of prominent black points except at apex and tornus and a fine white line at base of cilia. Hind wing white, slightly tinged with brown ; a brown terminal line and line near base of cilia.

*Ab.* 1. Fore wing with the ridges of raised scales with grey mixed.

*Hab.* TRANSVAAL, Nkwaleni (*Janse*), 1 ♂, Pretoria (*Janse*), 3 ♂, 1 ♀ type. *Exp.* 22 mm.

*Laodamia conisella*, sp. n.

♂. Head and thorax grey-white mixed with blackish, the tuft of scales at back of head black edged with white, the antennæ black, the palpi white irrorated with black ; the extremities of 2nd and 3rd joints white ; abdomen ochreous irrorated with black which forms obscure bands ; pectus, legs, and ventral surface of abdomen white, the legs thickly irrorated with black. Fore wing grey-white, thickly irrorated with blackish ; some diffused blackish on basal area ; antemedial line white defined on outer side by black and faintly on inner side by blackish, forming a patch above inner margin, somewhat oblique and slightly sinuous ; an oblique blackish discoidal bar ; subterminal line white defined on inner side by black and on outer side by diffused blackish, excurved at middle, a terminal series of black points except towards tornus. Hind wing semihyaline white with a slight

ochreous tinge, the costal area tinged with brown; a black-brown terminal line; cilia pure white with a dark line near base.

♀. The tuft of scales at back of head concolorous; fore wing with the antemedial line defined on each side by black-brown, diffused on inner side.

*Hab.* BR. E. AFRICA, Sabaki R. (Gregory), 1 ♀; TRANS-VAAL, Three Sisters (Janse), 1 ♂, 1 ♀ type. *Exp.* 24 mm.

*Laodamia psammathella*, sp. n.

Head and thorax brownish white irrorated with fuscous, the antennæ of male with the ridge of scales black; abdomen creamy white, dorsally irrorated with brown towards extremity, except the anal segment; tarsi banded with blackish. Fore wing brownish white thickly irrorated with blackish, except in discal fold from middle and in submedian fold; antemedial line white, defined on inner side by a broad band of blackish irroration and on outer by a fine blackish line, rather oblique and slightly angled inwards in the cell and at vein 1; a black point at lower angle of cell, some pale rufous scales below it below submedian fold and a slight streak of black scales on vein 1; subterminal line white defined on each side by blackish, oblique towards costa and slightly angled inwards at discal and submedian folds. Hind wing hyaline white, the costal area faintly tinged with brown; a brown terminal line and line near base of cilia except towards tornus.

*Hab.* SUDAN, Port Sudan (Waterfield), 2 ♂, 6 ♀ type. *Exp.* 20 mm.

Genus *HETEROCHROSIS*, nov.

Type, *H. molybdophora*, Lower (*Heterographis*), Tr. Roy. Soc. S. Austr. xxvii. p. 57 (1903).

Proboscis fully developed; palpi upturned, the 2nd joint typically reaching to above vertex of head, the 3rd moderate and thickly scaled; maxillary palpi filiform; frons smooth; eyes large, round; antennæ of male typically laminate and minutely ciliated; tibiæ smoothly scaled. Fore wing rather narrow, the costa slightly arched, the termen obliquely curved, vein 2 from towards angle of cell, curved; 3 from just before angle; 4-5 from angle, in line with the median nervure; 6 from upper angle; 8-9 stalked; 10-11 from cell. Hind wing with the cell about half the length of wing; vein 2 from angle of cell; 3 and 5 stalked, 4 absent; 6-7 from upper angle; 8 anastomising with 7.

*Heterochrosis oligochrodes*, sp. n.

♂. Head and thorax black-brown suffused with grey-white, the antennæ black; abdomen whitish suffused with brown; tarsi ringed with grey-white. Fore wing black-brown suffused with grey-white; antemedial line black defined on inner side by grey-white, oblique to median nervure and angled inwards at vein 1, some rufous before it below the cell crossed by a black streak above vein 1 with a black point before its basal extremity; some rufous in, beyond, and below end of cell; two black discoidal points; subterminal line whitish defined on outer side by a rather maculate black line, excurved to vein 2, then incurved; cilia with a dark line near base defined on outer side by white and some white at tips. Hind wing semihyaline white, the veins and costa tinged with brown; a dark terminal line and brown line near base of cilia.

*Hab.* BR. E. AFRICA, Taveta (*Rogers*), 1 ♂; TRANSVAAL, Pretoria (*Janse*), 1 ♂ type. *Exp.* 14–22 mm.

*Heterochrosis zeylanica*, sp. n.

Head and thorax grey mixed with iron-brown, the antennæ brown, the basal joint and ridge of scales on outer side white; abdomen white, dorsally suffused with brown; pectus whitish; legs whitish, suffused with brown. Fore wing whitish mixed with iron-brown; antemedial line very indistinct, dark, oblique to discal fold, then incurved, a patch of red-brown scales before it on vein 1; two blackish discoidal points; subterminal line white defined on each side by dark brown, incurved at discal and submedian folds; a terminal series of dark brown points. Hind wing white tinged with red-brown; a dark terminal line and brownish line near base of cilia.

*Hab.* CEYLON, Puttalam (*Pole*), 1 ♂, 1 ♀ type. *Exp.*, ♂ 18, ♀ 14 mm.

*Heterochrosis holophæa*, sp. n.

♀. Head, thorax, and abdomen dark brown mixed with some whitish, the antennæ blackish, the extremity of abdomen fulvous; tarsi ringed with white. Fore wing dark brown mixed with some whitish and without markings; a white line at base of cilia. Hind wing reddish brown slightly

tinged with grey; a dark terminal line and white line at base of cilia.

*Hab.* MASHONALAND, Salisbury (*Marshall*), 1 ♀ type.  
*Exp.* 16 mm.

*Heterographis deterrentella*, sp. n.

♀. Head, thorax, and abdomen fuscous brown mixed with whitish, the anal tuft rufous, the antennæ fuscous; pectus, legs, and ventral surface of abdomen white tinged with brown. Fore wing fuscous brown mixed with some white; a diffused white streak on base of vein 1; a white antemedial line from cell to inner margin, some pale rufous before it below the cell; a slight whitish discoidal striga and dark point at lower angle of cell; subterminal line white defined on inner side by fuscous, incurved at discal and submedian folds, where there is some pale rufous on its outer side; a terminal series of slight dark points. Hind wing white tinged with brown, especially on terminal area; cilia brown at base, white at tips.

*Hab.* BR. C. AFRICA, Mt. Mlanje (*Neave*), 1 ♀ type.  
*Exp.* 20 mm.

Genus EULOPHOTA, nov.

Type, *E. caustella*, Hmps. (*Pristarthria*), Rom. Mém. viii. p. 548, pl. 57. f. 13 (1901).

Proboscis fully developed; palpi of male upturned, the 2nd joint reaching to rather above vertex of head and hollowed out to receive the large brush-like maxillary palpi, the 3rd small and oblique; frons smooth, with lateral tufts of scales; eyes large, round; antennæ of male laminate and minutely serrate, the basal joint long and dilated, the shaft with elongate sinus at base with minute scale-tooth before it; tibiæ smoothly scaled; abdomen with small flattened crests on two basal segments. Fore wing narrow, the apex rounded, the termen evenly curved; vein 2 from well before angle of cell, oblique; 3 from just before angle; 4-5 strongly stalked, not in line with the median nervure; 6 from upper angle; 8-9 stalked; 10-11 from cell; an antemedial ridge of raised scales on upper side from below costa. Hind wing with the cell about one-third length of wing; vein 2 from angle of cell; 3 strongly stalked with 4-5; the discocellulars oblique; 6-7 stalked; 8 not anastomising with 7.

*Eulophota zonata*, sp. n.

Head, thorax, and abdomen grey-white tinged with fuscous brown, the last with some black scales at base, the antennæ blackish above; fore and mid legs mostly black, the tarsi black ringed with white. Fore wing with the basal area, including the ridge of raised scales, very deep chocolate-red glossed with grey, a glaucous green patch at base of inner margin; antemedial line pure white with a glaucous green patch on its inner side, its outer side defined by somewhat raised black scales excurved to median nervure, then incurved; postmedial area white and brown with an indistinct, somewhat annulate, brown discoidal spot and the costa above end of cell brown; subterminal line dark brown defined on outer side by white, minutely dentate, incurved at discal and submedian folds; terminal area rufous shading to brown at termen, the costal area brown and white to vein 6; a terminal series of black-brown bars with white points between them and a fine white line at base of cilia. Hind wing semihyaline white tinged with ochreous brown, the termen brown; cilia white with a brown line near base.

*Hab.* CAPE COLONY, Annshaw (*Miss F. Barrett*), 1 ♂, 1 ♀ type. *Exp.*, ♂ 20, ♀ 24 mm.

## Genus ARGYBORHABDA, nom. nov.

*Argyrodes*, Guen. Eur. Micr. Ind. Meth. p. 84 (1845), non descr., nec Sim. Arachn. 1864.

Type, *A. vinetella*, Fabr. (*Tinea*), Mant. ii. p. 242 (1787).

*Argyrorhabda leucomera*, sp. n.

♂. Head and thorax bright rufous, the palpi white, fuscous brown above; abdomen white faintly tinged with brown; pectus, legs, and ventral surface of abdomen white tinged with fuscous. Fore wing with the costal area silvery white irrorated with black, narrowing to a point at apex, a fine black streak below it and the costal edge black towards base; the wing then bright rufous to submedian fold and the inner area ochreous white; the veins with slight streaks of blackish scales; a black point at lower angle of cell; cilia white mixed with fuscous and with a fine white line at base. Hind wing white tinged with ochreous brown; a fine blackish terminal line; cilia with a brownish line near base.

*Hab.* S. RHODESIA, Saw-mills (*Janse*), 1 ♂ type; TRANSVAAL, Eukeldoorn (*Janse*), 1 ♂. *Exp.* 28 mm.

LXXIV.—*The Spedan Lewis South American Exploration.*—  
V. *Mammals obtained by Señor E. Budin in Neuquen.*  
By OLDFIELD THOMAS and Miss J. ST. LEGER.

ONE of the largest geographical gaps in the series of collections made by Señor E. Budin along the Argentine Cordilleras has been that between his Nahuel Huapi collection of 1918 and that from San Juan (1921), and it was therefore arranged that in carrying on the Spedan Lewis Exploration he should visit the Province of Neuquen, whence the British Museum had previously had practically no specimens at all.

Unfortunately, owing to all the collecting-area being at a considerable altitude and the season being late, wintry conditions came on before Sr. Budin could make anything like a complete collection. None the less, the series of which we now give an account proved of much interest, and several new forms were discovered, of which the most notable are a fine new tuco-tuco (*Ctenomys emilianus*) and a mountain chinchilla (*Lagidium*), to which latter I have had much pleasure in attaching the name of Mrs. Spedan Lewis, who has taken much interest in the collections made by her husband's help.

The localities at which Sr. Budin worked were three in number, all situated on a north and south line on about 70° W. long:—

*Chos Malal*, alt. 805 m., at about 37° S. lat.; *Las Lajas*, alt. 640 m.; and *Zapala*, alt. 1060 m.: the two latter about 37° S. lat. All are in the Province (Gobernacion) of Neuquen, and on the upper waters of the Rio Neuquen, Upper Rio Negro. The mountain chinchillas were obtained at Pino Hachada, 45 km. N.W. of Las Lajas, 1500 m.

The collection thus fills in an important lacuna in our series of Andean mammals, whose knowledge has been so vastly increased by Señor Budin's work. For this, in turn, we have to express our gratitude to Mr. Spedan Lewis, who has enabled that work to be continued.

1. *Conepatus proteus*, Thos.

♀. 2419. Chos Malal, 805 m.

Not fully adult, so that the determination is a little doubtful.

2. *Phyllotis xanthopygus*, Waterh.

7 ♂, 5 ♀. Chos Malal, 805 m.

♂. 2505; ♀. 2508, 2519. Las Lajas, 640 m.

These Neuquen specimens have, as a rule, whiter bellies than those which Messrs. Budin and Box obtained near Nahuel Huapi, but one or two are similarly buffy below.

The differences between the various forms of this group, being open-country animals not restricted by definite barriers, are exceedingly intangible, and we are by no means sure that the true *xanthopygus* of the south will not be found to grade into the original *Ph. darwini* of Central Chili.

### 3. *Eligmodontia typus*, F. Cuv.

13 ♂, 4 ♀. Chos Malal, 805 m.

6 ♂, 8 ♀. Las Lajas, 640 m.

♂. 2395; ♀. 2400, 2406. Zapala, 1062 m.

### 4. *Reithrodon cuniculoides*, Waterh.

♂. 2401. Zapala, 1062 m.

### 5. *Akodon nucus*, sp. n.

11 ♂, 8 ♀. Chos Malal, 800 m.

♀. 2509. Las Lajas, 640 m.

A medium-sized brown species without marked characteristics. Chin white.

Size less than in *A. dolores*, greater than in *A. iniscatus*, these being the species to which *A. nucus* has the greatest resemblance. Fur rather short, hairs of back about 8 mm. in length, very different from the long soft fur of *A. neocenus*. General colour above finely lined brown, about as in *iniscatus*. Below dull soiled whitish or buffy whitish, a small area in the anal region more strongly buffy; chin with a distinct white spot. Eyes with an indistinct buffy ring. Ears short, brown, the hairs on the metentote more or less buffy. Hands and feet dull buffy whitish. Tail prominently bicolor, blackish above, buffy whitish below.

Skull of normal shape, not strongly ridged, the interorbital region of average breadth, parallel-sided, its upper surface flat, but with smoothly rounded edges. Zygomatic plate well projected forwards, its front edge vertical. Palatal foramina long, reaching to the middle of  $m^1$ .

Incisors orthodont, without any of the proodonty so marked in the otherwise very similar members of the *obscurus* group; incisive index of type  $73^\circ$ , of the oldest specimen obtained  $76^\circ$ .  $M^1$  with a groove on its front face.

Dimensions of the type:—

Head and body 104 mm.; tail 77; hind foot 23; ear 14.

Skull: greatest length 27·2; condylo-incisive length 25; nasals 10; interorbital breadth 4·5; breadth of brain-case 12·2; zygomatic plate 3; palatilar length 11; palatal foramina 6·5; upper molar series 4·1.

*Hab.* as above. Type from Chos Malal.

*Type.* Adult, but not aged, male. B.M. no. 26. 10. 11. 42. Original number 2473. Collected 1st May, 1926.

I am quite unable to find a name for this ordinary-looking vole-mouse. The species most like it—*benefactus*, *obscurus*, *lenguarum*, and their allies—all have more proodont incisors, while *dolores* of Cordova has a much broader interorbital space. The more southern species *beatus* and *iniscatus* are both much smaller, but perhaps it may be most allied to the latter, with which it shares the general build of the skull. Its neighbour, *A. neocenus*, is larger, with very much longer fur.

#### 6. *Ctenomys emilianus*, sp. n.

♂. 2436, 2443, 2446, 2447, 2459, 2462, 2467, 2472; ♀. 2468, 2476, 2487. Chos Malal, 805 m.

A fine large species of a pale fawn-colour.

Size large, about as in *C. opimus* and *luteolus*, smaller than the very large species such as *tuconax* or the southern *C. fodax* and its allies. General colour above pale glossy fawn or wood-brown, uniform on head and back, without frontal blackening. Sides and belly buffy whitish, this colour extending further up the sides than usual, and passing on to the hips and thighs, where it forms a striking contrast with the brown colour of the rump. Bases of hair, as usual, slaty; chin and throat nearly concolorous with belly. Sides of neck below ears paler fawn. Hairs of hands, feet, and tail glossy buffy whitish, the last-named practically without any blackening of its terminal crest.

Skull, compared with that of *C. opimus*, of about the same length, but more slenderly built, lower, and flatter, the zygomatica well expanded behind, but without the unusually convex shoulders of *opimus*. Nasals rather narrow. Interorbital region flattened, narrower than in *opimus*. Brain-case low, its upper surface well-ridged, the two masseteric ridges well defined, approaching in old age to within about 2 mm. from each other. Lambdoidal ridges well defined. No vertical occipital central ridge. Bullæ rather large, well inflated, very different from the narrow bullæ of *C. pontifex*.

Teeth normal, the premolar not specially enlarged. Incisive index of type 96°.



Dimensions of the type:—

Head and body 211 mm.; tail 91; hind foot 39.

Skull: greatest median length 50; condylo-incisive length 52; zygomatic breadth 33; nasals  $19.3 \times 8$ ; inter-orbital breadth 11; breadth across brain-case 18.8; bimeatal breadth 32.8; breadth between outer corners of anteorbital foramina 22.3; diastema 15; palatilar length 23; oblique length of bullæ 19. Upper tooth-series (crowns) 10.

*Hab.* Chos Malal, Prov. Neuquen. Altitude 805 m.

*Type.* Adult male. B.M. no. 26. 10. 11. 54. Original number 2446. Collected 24th April, 1926.

This fine species is readily distinguishable by its clear fawn colour, contrasting with the whitish belly and sides, and its low flattish skull, whose various characters are detailed above. No described species seem to be very closely related to it, although, as usual in this troublesome genus, there are no obvious superspecific characters.

Remembering the very special interest Sr. Budin has taken in this widely spread genus, and his remarkable success in discovering new forms of it, I have great pleasure in basing the name of this particularly fine tuco-tuco on his Christian name, as a small tribute to his work.

The following occurs in one of Sr. Budin's letters:—

"In a few days' time I shall be leaving Chos Malal, and I trust you will be satisfied with my stay here, as I may inform you that I have in my possession two new varieties of tuco-tucos, apart from the ones from Zapala. This is the first time, since I started collecting, that I have noticed two kinds of *Ctenomys* living in the same area.

"To begin with Zapala, I may note that the tuco-tucos secured there are generally small, yellowish grey on the back, and yellowish silver on the abdomen. About 1 kilometre east of Chos Malal I found almost the same variety of *Ctenomys*, but generally of larger build. Continuing to explore, I moved a couple of kilometres to the N.W. of the town, crossing the Curileofu River, looking for specimens in the triangle formed by the Corileofu and Neuquen Rivers. This place is very flat, and in parts there are a number of dunes, where the soil is sandy. As soon as I explored the ground I noticed tuco-tuco burrows, but larger than those seen further east. Convinced that it must be a different kind of animal, I immediately set my traps, and on the following day I had the good fortune to secure what appeared to be a new variety of tuco-tuco, very much larger and different from those caught at Zapala. The colour of this tuco-tuco is yellowish ochre on the back and pale yellow on the abdomen. I have

called it "*Ctenomys de las Dunas*," because it prefers to live on the sand-dunes, which in this spot reach a height of 2 to 3 metres."

7. *Ctenomys mendocinus*, Phil.

6 ♂, 13 ♀. Chos Malal, 805 m.

7 ♂, 8 ♀. Las Lajas, 640 m.

6 ♂, 1 ♀. Zapala, 1062 m.

This species evidently ranges over a wide area—from Mendoza, through San Rafael and Tupungato, down to the present region. Possibly even *C. haigi*, from considerably further south, will be found to grade into it.

The present is also very near the type-locality of Philippi's *C. maulinus*, viz., Laguna de Maule, Eastern Chile, about 36° S., and, as the measurements agree closely, it is probable that *maulinus* should be considered as a synonym of *mendocinus*.

There is considerable variation in the general colour, from grey to buffy brown, and the blackish line on the tail is sometimes strongly developed along the whole length, and is sometimes practically absent or is represented only by a few black hairs in the terminal crest.

At San Rafael there also occurs the larger species discovered by Mr. Bridges—*C. pontifex*,—distinguished by its narrow skull and peculiarly narrow bullæ.

8. *Lagidium saræ*, sp. n.

♂. 2529; ♀. 2527, 2528. Pino Hachado, Neuquen, 1500 m.

A dark-coloured species, with short ears.

Size rather large. Fur very thick and woolly, the hairs of the back about 35 mm. in length (winter); woolly region at base of tail of greater extent than usual. General colour "mouse-grey," without the buffy or yellowish suffusion found in *L. boxi*, which appears to be the nearest ally; darker grey than in *viatorum* and *tontalis*. Under surface soiled greyish, the tips of the hairs buffy whitish, stronger buffy in the inguinal region. Dorsal black line well marked, commencing on the occiput, not extending on to the rump. Intermingled black lines on back more numerous than usual, their tips giving a black profile-line when viewed from the side. Ears short, about as in *boxi*, conspicuously shorter than in *viatorum* or *tontalis*. Hands and feet dark grey, nearly matching the body. Tail of the usual mixed greyish colour, with black under surface.

Skull of about the same size as in *L. boxi*. Muzzle rather narrower, though not so much so as in *moreni*. Premaxillary processes slightly surpassing the nasals, not so much as in *moreni*. Supra-meatal islands large. Palatal foramina long, the anterior palatal fissure as in *boxi*. Bullæ rather smaller than in *boxi*, the vertical face of the mastoid behind the meatal opening smaller, about 6 as compared with 7.5 mm. in breadth.

Incisors white or faintly yellowish in front. Cheek-teeth large, as in *L. boxi*, markedly larger than in *moreni*, the first lamina of  $m^1$  5.8 mm.

Dimensions of the type:—

Head and body 413 mm.; tail 376; hind foot 110; ear 63.

Skull: greatest length 93.5; condylo-incisive length 84; zygomatic breadth 49; nasals  $33 \times 12.8$ ; interorbital breadth 21.5; palatilar length 42.5; palatal foramina 17; horizontal length of bulla 15; cheek-teeth (crowns) 22; molars only 16.5.

*Hab.* as above, some 600 km. south of the type-locality of *viatorum* and 260 north of that of *boxi*.

*Type.* Adult female (basilar suture not quite closed). B.M. no. 26. 10. 11. 85. Original number 2528. Collected 9th June, 1926.

This fine species is readily distinguishable by its dark grey colour, short ears, large molars, and narrow mastoids. Geographically it just fills the gap between *L. viatorum* of the Mendoza-Valparaiso route on the north and *L. boxi* from Pilcañeu, near Nahuel Huapi, on the south, differing from each of them in the various details above noted.

It is named in honour of Mrs. Lewis, to whom we have every reason to be grateful for her encouragement of the South American Exploration.

In a letter dated the 5th June Sr. Budin writes from Las Lajas:—"I hope soon to go to Pino Hachado, where I am told there are vizcachas. I was shown a skin very different from those of the north. It is large, very dark in colour, almost black, and with small ears. I should not like to end the exploration without sending you this animal, which I am very anxious to see."

The above description shows to what good effect Sr. Budin carried out his intentions.

### 9. *Galea negrensis*, Thos.

♂. 2498. Chos Malal, 805 m.

10. *Caviella australis nigriana*, Thos.

♂. 2481; ♀. 2433, 2437, 2463, 2469. Chos Malal, 805 m.

♂. 2523, 2540; ♀. 2504, 2537, 2544. Los Lajas, 640 m.  
♀. 2393, 2394, 2397. Zapala, 1062 m.

11. *Dasypus villosus*, Desm.

♂. 2482. Chos Malal, 805 m.

12. *Marmosa elegans pallidior*, Thos.

9 ♂, 1 ♀. Chos Malal, 805 m.

♂. 2541; ♀. 2511, and 4 ♀ in spirit. Las Lajas, 640 m.  
♀. 2405. Zapala, 1062 m.

In spite of the considerable geographical gap between Neuquen and the most southern locality from which we have hitherto had *pallidior*—Rioja,—I can see no reason to distinguish these *achocayas* from that form. True *elegans* from the Chilian side of the Andes is generally larger.

Being captured in the winter, these specimens have enormously swollen tails, of which some attain no less than 45 mm. in circumference.

LXXV.—*Contributions towards a Knowledge of the European Thysanoptera*.—I. By RICHARD S. BAGNALL, F.R.S.E., F.L.S.

THIS is the first of a series of papers dealing with the European Thysanoptera other than British, describing new species and, more particularly, opening up our knowledge of certain countries, including Switzerland, Italy, France, and Spain. From Italy and Spain I have received valuable material from Sign. C. Minozzi and the Rev. Longinos Navas, S.J., respectively; otherwise my records are chiefly from small collections made by myself during brief visits in Norway, Sweden, Denmark, Switzerland, Belgium, and France, and, more particularly, from a recent extended visit to the Eastern Pyrenees. The last-named included excursions into Spain and Andorra, where, after about a fortnight's collecting, I was joined by my friends Mr. S. Campbell, Dr. J. W. H. Harrison, F.R.S.E., and Prof. A. D. Peacock, F.R.S.E. On my departure they carried out a collecting-trip up the Val d'Eyne into Spain, securing valuable material, which, unfortunately, was for the most

part destroyed on the journey home. Records from Aja and Nuria in Spain and from the Val d'Eyne are for the most part due to Harrison's energy.

In 1925 Priesner published his "Katalog der Europäischen Thysanopteren" ('Konowia,' iv. pp. 141-159), which may be regarded as a useful basis for further work, giving as it does the known distribution of each species. I have not had an opportunity of reviewing this Catalogue, and therefore questions of synonymy, criticisms, omissions, etc., will be dealt with herein from time to time. A brief perusal demonstrates the following omissions:—

Genera: *Retithrips*, Marchal, *Microcanthothrips*, Bagn., *Gynaikothrips*, Karny, and *Docessissophothrips*, Bagn.

Species: *Retithrips ægypticus*, Marchal (Egypt); *Anaphothrips alternans*, Bagn. (Egypt); *Frankliniella priesneri*, Bagn. (Tunisia); *Thrips assimilis*, Bagn. (Tunisia); *Haplothrips longisetis*, Bagn. (Egypt); *Microcanthothrips spinosus* (Bagn.) (Belgium); *Gynaikothrips uzeli* (Zimm.) (Algeria, Canaries, and Madeira); *Cryptothrips insularis*, Bagn. (Canaries); and *Docessissophothrips longiceps*, Bagn. (Madeira).

In a paper now in the press I have described the following species from the British Isles:—*Æolothrips tenuicornis*, *Frankliniella anglicana*, *Oxythrips quercicola*, *O. pernicious*, *Trichothrips amabilis*, and *T. britteni*, spp. n.

In the following pages *Limothrips incertis*, sp. n., *Anaphothrips vitalbæ*, sp. n., *A. tamaricis*, sp. n., *Euphysothrips minozzii*, gen. et sp. n., *Oxythrips navasi*, sp. n., *Tæniothrips italicus*, sp. n., *T. sodalis*, sp. n., *Thrips debilis*, Bagn., ♂, *Thr. robustus*, Pr., ♂, *Thr. frankeniæ*, sp. n., *Haplothrips longipes*, sp. n., *H. pineticola*, sp. n., *Cephalothrips harrisoni*, sp. n., *C. coxalis*, sp. n., and *Phlæothrips bispinoides*, sp. n., are described.

*Thrips herricki*, Bagn., recently described from the U.S.A., is an addition to the European fauna, whilst *Aptinothrips nitidula*, Hal., *Anaphothrips tamicola*, Bagn., and *Thrips debilis*, Bagn., are British species now for the first time recorded from the mainland of Europe.

All other records are, I think, without exception additions to the countries from which they are recorded.

#### *Limothrips incertis*, sp. n. (Figs. 2 & 4.)

♀.—This species is less heavily built than *L. denticornis* (Hal.), to which it is closely allied. It differs in a number

of characters, but it would be desirable to have more material before drawing up a description; it is possible that the two species are mixed in collections.

The antennal joint 3 is not so acutely produced, and the sense-cone on the dentiform part is shorter than in *denticornis*; joints 4 and 6 are subequal, or 6 only slightly longer than 4, whereas in *denticornis* 6 is noticeably longer than 4, which latter joint is generally markedly asymmetrical in *denticornis*. The postero-angular bristle of the pronotum is shorter than in *denticornis*, but the abdominal spines on segments 9 and 10 are noticeably longer and less stout (84:54  $\mu$  in *denticornis* and 98:70  $\mu$  in *incertis*). Whilst the bristles on segment 9 are as long or slightly longer than in *denticornis*, those on 10 are weak and distinctly shorter (102 and 66  $\mu$  respectively).

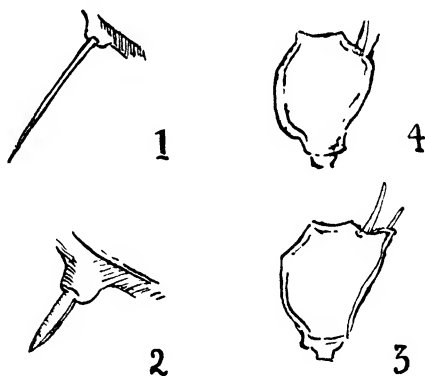


Fig. 1.—Lateral spine of chitinous band in abdominal segment of *Limothrips denticornis*, ♂.

Fig. 2.—Ditto of *Limothrips incertis*, sp. n., ♂.

Fig. 3.—Third joint of right antenna in *L. denticornis*, ♂.

Fig. 4.—Ditto of *L. incertis*, sp. n., ♂.

♂.—The spine at each end of the chitin-band of abdominal segment 9, which is long and slender in *denticornis* (see fig. 1), is short, stout, and set upon a papilla (see fig. 2), whilst the third antennal joint, though slightly produced, is not dentiform (see fig. 4).

*Hab.* FRANCE, Eastern Pyrenees, Ax-les-Thermes, on *Hordeum*, both sexes; Font Romeu, at about 6000 ft., on a woodland grass, 1 ♀; SPAIN, near Puigcerda, on *Avena*, 1 ♀ and 1 ♂, August 1926.

*Limothrips denticornis*, Hal.

*Hab.* FRANCE, L'Hospitalet, 2 ♂♂ on a *Festuca*, c. 5500 feet, vii. & viii. 1926.

*Limothrips angulicornis*, Jabl.

*Hab.* FRANCE, Ax-les-Thermes, 1 ♀ on grass, viii. 26. SPAIN, Puigcerda, 1 ♀ on *Verbascum*, viii. 26.

Previously known from England, Hungary, Sardinia, Armenia, Transcaucasia, North America, and Australia.

*Aptinothrips nitidula*, Hal.

A salt-marsh species, previously only known from the British Isles.

*Hab.* FRANCE, Arcachon, banks of the Teste near its mouth, viii. 26.

*Anaphothrips vitalbæ*, sp. n.

♀.—Length about 1.1 mm.

Near *A. omissus*, Pr. Yellow, legs and wings pale greyish-yellow, lower cilia of wings darkish brown, wavy. Antenna with joint 1 pale, almost colourless; 2 shaded with brown; 3 brown, paler at apex and pale (almost colourless) in the basal third or thereabouts; 4 and 5 similarly brown, but pale in basal half and third or thereabouts respectively and colourless at extreme base; 6–8 uniformly brown. Eyes black. Ocelli without crimson hypodermal pigmentation. Head transverse, about 0.72–0.75 as long as broad; eyes coarsely faceted and prominent, owing to constriction to cheeks, which are moderately arcuate. Antenna of the type seen in *Dictyothrips betæ*, Uz., *Anaphothrips omissus*, Pr., *A. orchidaceus*, Bagn., and *A. tamicola*, Bagn., with joints 3 and 4 elongated, broadest near distal fourth, and then constricted. Relative lengths (and breadths) of the joints 3–8 approximately:—

62 (19) : 57 (18) : 36 (17) : 51 (19) : 8 : 13  $\mu$ .

Pronotum transverse, about 0.66 as long as broad, and not or scarcely longer than the head. Bristles on the forewings minute, 10+1 on lower vein and 1+1 (the latter much longer than the others) at apex of the upper vein.

Abdomen with apical bristles on segments 9 and 10 grey-brown, short, those on 10 being noticeably stout, their length about 40  $\mu$ .

Length (and breadth) of head and pronotum approximately 104 (140) and 106 (160)  $\mu$  respectively ; length of fore-wing 560  $\mu$ , and lengths of abdominal segments 9 and 10 about 60  $\mu$  each.

*Hab.* ITALY, S. Vito (Modena), on " Vitalba " (*Clematis vitalba*), 9. vii. 17, ♀ ♀ only (*C. Minozzi*).

*Anaphothrips tunicola*, Bagn.

Another species previously only known from the British Isles ; it lives in the flowers of *Tamus communis*, and the pink larva is distinctive. The ♂ is unknown.

*Hab.* FRANCE, in a wood above Ax-les-Thermes, 1 ♀, numerous larvæ ; Val d'Eyne, on road to Nuria, viii. 26. SPAIN, near Aja, viii. 26.

*Anaphothrips orchidaceus*, Bagn.

A beautiful hot-house species, previously recorded from the British Isles and Belgium. I have also taken it in Norway, Denmark, Sweden, and France.

*Anaphothrips tamaricis*, sp. n.

♀.—Length c. 0.8 mm.

Dark grey-brown, thorax lighter, more of a yellowish-brown ; fore-tibiæ and all tarsi yellowish-brown. Antenna with joints 1, 3, and 4 greyish-yellow, base of 5 inclined to be pale ; 2 very dark brown and 6 to 8 grey-brown, but darker than 5. Wings fumate.

Head transverse, 0.6 as long as broad ; cheeks wider than eyes, arcuate ; eyes coarsely faceted, interocellar setæ short, situated between anterior and posterior ocelli. Antenna normal, joint 1 short, 2 heavy, 5 and 6 somewhat broadly united.

Pronotum a little longer than the head, transverse, about 0.6 as long as broad ; posterior margin with six pairs of setæ, of which the outermost is about 2.0 times as long as the others and 0.22 the median length of the pronotum.

Wings broad, lower fringe wavy ; setæ of the fore-wing minute, costa with 20–22, hind-vein with 9 or 10 more or less irregularly disposed, and distal part of fore-vein with 3 (1+1+1). Fore and intermediate legs short and stout, hind pair longer.

Abdominal tergite 8 with lateral indication of "comb"



only. Apical bristles on 10 shorter and weaker than those on 9.

Length (and breadth) of head and pronotum 95 (154) and 114 (195)  $\mu$  respectively; of fore wing 608 (52)  $\mu$ , and length of abdominal segments 9 and 10 about 52  $\mu$  each, the length of bristles on them being 60 and 45  $\mu$  respectively. Approximate lengths (and breadths) of antennal joints:—

$$\begin{array}{l} 13\cdot5 \text{ (27)} : 35 \text{ (27)} : 38 \text{ (18}\cdot5) : 34 \text{ (19)} : 30 \text{ (19)} : \\ 41\cdot5 \text{ (18)} : 7 : 11\cdot5 \mu. \end{array}$$

♂.—Smaller and more slender, abdominal sternites 3–6 with an elliptical area, and tergite 9 with a dorsal series of four setæ, the inner pair (on a lower plane) being short and spine-like, less than 0·5 the length of the outer pair, the measurements being as follows:—

$$\begin{array}{l} \text{Outer } 30 \mu \text{ long, separated by } 33 \mu. \\ \text{Inner } 13 \mu \quad \text{,,} \quad \text{,,} \quad 11 \mu. \end{array}$$

*Hab.* FRANCE, Canet-le-Plage, near Perpignan, plentiful in flowers of *Tamarix gallica*, viii. 1926.

#### Genus EUPHYSOTHRIPS, nov.

Near *Physothrips*; head widening from behind eyes to base; antenna with 2-jointed style; mouth-cone long, reaching across the prosternum; maxillary palpi 3-jointed, long. *Two pairs of long postocular bristles. Two long bristles at each hind angle of the pronotum, the outer much longer than the inner. Lower vein of fore-wing without a regular series of setæ, but with a few scattered ones. Fringe of abdominal tergite 8 long.*

Type. *Euphysothrips minozzii*, m.

This genus may be recognized chiefly by the presence of two pairs of post-ocular bristles and the chaetotaxy of the wings, which correspond with those of *Anaphothrips* in having both veins of fore-wing furnished with a few scattered setæ.

#### *Euphysothrips minozzii*, sp. n. (Fig. 5.)

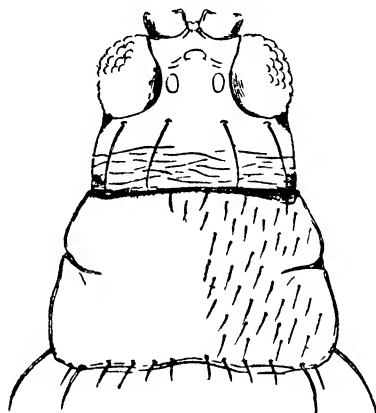
♀.—Length 0·95 mm.

Head pale yellowish-brown, posteriorly darker grey-brown; thorax yellowish-brown to grey-brown; abdomen grey-brown, with segments 8–10 darker—in the type-example 9 and 10 dark grey-brown and darker than 8. Legs

brownish-yellow. Wings pale greyish-brown. Antenna with joints 1 and 2 concolorous with the darker part of the head; 5-8 of a uniform dark grey-brown, with extreme base of 5 yellowish; 4 also dark, but paler than 5 and 6 and yellowish apically and distally; 3 wholly yellow.

Head as described for the genus (fig. 5), about 0.8 as long as broad; length of the post-ocular bristles (the inner pair of which are situated well below the posterior ocelli and separated by c.  $36\mu$ ) about  $38\mu$ . Length of the joints of the maxillary palpi i. 18, ii. c. 13, and iii. c.  $15\mu$ . Antenna about 2.5 times the length of the head, joint 3 constricted at base, symmetrically rounded at sides, and vase-shaped distally; 4 with basal constriction and distal production

Fig. 5.



Head and pronotum of *Euphysothrips minozzii*, gen. et sp. n.

narrower than in 3; 5 with short constriction at base, apex somewhat broad and broadly united to 6; style short, 0.4 the length of 6.

Pronotum roundly widening to its broadest near base, where it is more than 1.5 times as broad as long; dorsal surface sparingly setose, the setæ being somewhat long (c.  $18-24\mu$ ) and fine; outer postero-angular bristle much longer than the inner (from 46 to  $50\mu$ , as compared to 30 to  $34\mu$  in length); postero-marginal and the inter-postero-angular setæ 17 to  $21\mu$  long. Fore-wing with 17 widely spaced, long, pale costal setæ, those near middle about 1.2 times as long as the breadth of the wing; vein-setæ some-

ple, few, and scattered, basal series 2 + 2 or 2 + 3  
h vein; lower fringe wavy.

and obconical, narrowing from base of  
segment 8; segment 10 shorter than 9 (60 as to 90  $\mu$ ),  
bristles on the segment bearing them.  
"Comb" of tergite 8 long, cilia irregular and from 16 to  
24  $\mu$  in length.

Length of head 92, breadth across eyes 120 and at base  
126  $\mu$ ; length (and breadth) of pronotum 114 (176)  $\mu$ ;  
width of pterothorax 216  $\mu$ ; length (and breadth) of femora  
and tibiæ i. 110 (42):100 (38); ii. 102 (33):95 (33); and  
iii. 116 (38):118 (32)  $\mu$ . Relative lengths of antennal  
joints approximately:—

16 (25):c. 35 (24):54 (21):46 (22):31 (17.5):  
38 (16.5):5.5:10  $\mu$ .

*Hab.* FRANCE, on the outskirts of Perpignan, ♀ ♀ in the  
flowers of *Clematis vitalba*, viii. 26.

I have pleasure in dedicating this species to Sign. C.  
Minozzi.

*Chaetanaphothrips orchidii* (Moulton).

A hot-house species previously known from the British  
Isles, Belgium, Holland, and North America. I have also  
collected it in Norway, Sweden, Denmark, and France.

*Oxythrips ajugæ*, Uzel.

Previously known from Bohemia, British Isles, Germany,  
Poland, and Austria.

*Hab.* FRANCE, Font Romen, at about 6000 ft., 1 ♀ and  
larvæ on *Pinus* and 1 ♀ in flower of *Gentiana lutea*, viii. 26.

*Oxythrips ulmifoliorum* (Hal.), Bagn.

Previously recognized from Great Britain and Austria.

*Hab.* FRANCE, Fontainebleu, on leaves of *Ulmus*, viii. 26.  
SPAIN, Arnes (Tarragona), ♀ ♀ only, 28. viii. 13 (*Longinos*  
*Navas*).

*Oxythrips navasi*, sp. n.

♀.—Length about 0.9 mm.

Abdomen deep chestnut-brown, segments 9 and 10 paler;  
head, thorax, and fore-legs yellow, largely shaded with a

reddish-brown to brown; intermediate and hind legs, excepting tarsi, brown. Wings light smoky brown. Antennæ brown, joints 1, 3, and 4 paler and much as in *O. ulmifoliorum*. Head transverse, about 0·7 as long as broad, cheeks broader than across eyes, antennæ more than twice as long as the head; pronotum scarcely longer than the head, sides subparallel, seta at each hind angle short, about 0·2 the median length of the pronotum. Pterothorax large, quadrate. Wings long and broad, upper vein of fore-wing with 1 seta at distal two-fifths and 1 + 1 at apex; hind vein with a series of 4 at base, then 1 + 1, a space, and 1 + 1, these latter being scarcely longer than the preceding (about 22 to 24  $\mu$  in length); costa with 25–26 setæ.

Length (and breadth) of head, pronotum, pterothorax, and fore-wing approximately 95 (140), 100 (160), 200 (220), and 590 (48)  $\mu$  respectively. Width of abdomen 245  $\mu$ . Relative lengths (and breadths) of antennal joints 3–8 approximately as follows:—

37 (19) : 33 (18) : 29 (18) : 40 (18) : 7 : 12.

Antennal joint 3 asymmetrical, the inner margin gently arcuate and the outer angulate at distal fourth.

Length of postero-angular seta of pronotum 20, of bristles on abdominal segment 9, 52 (innermost) to 60, and on 10, 54 (inner) and 46  $\mu$ .

This species differs from *O. ulmifoliorum* in its small size, its deeper and richer coloration, the dark intermediate and hind legs, the longer and stouter wings, and the very much shorter pronotal and apical abdominal bristles, those on segment 9 being 86–96  $\mu$  in *ulmifoliorum* as compared to 52–60  $\mu$  in *navasi*.

*Hab.* SPAIN, Saragossa, viii. 1913 (*Longinos Navas*).

I have pleasure in naming the species after its distinguished discoverer.

### *Physothrips frontalis* (Uzel).

*Hab.* NORWAY, between Fevig and Arendal, vi. 1909, 1 ♀ by sweeping.

Previously known from Bohemia and Austria.

### *Physothrips pini* (Uzel).

*Hab.* NORWAY, Bygdø, near Christiania, vii. 1909, ♀ ♀ on *Abies*. SWITZERLAND, Zurich district, on *Abies*, near the summit of the Uetliberg, viii. 25.

*Physothrips dianthi*, Pr.

Recently described by Priesner from Austria and Dalmatia. All the following records are from the flowers of *Dianthus carthusianorum* and of ♀ ♀ only, August 1926.

*Hab.* FRANCE, Ax-les-Thermes and Montlouis. ANDORRA, near L'Hospitalet. SPAIN, in two valleys south of Aja and Vilallorest.

*Physothrips propinquus*, Bagn.

A rare species known from Great Britain and Austria. The specimen recorded below has longer and darker cephalic and pronotal bristles than in British example.

*Hab.* France, Montlouis, at c. 5200 feet, 1 ♀ by beating *Cistus*, viii. 26.

*Teniothrips italicus*, sp. n.

This species comes nearest to *T. primulae* (Hal.) as regards size of both sexes and the form of the transverse pale areas in the abdominal sternites of the male.

♀.—Length 1.4–1.55 mm.

Head broader than in *primulae* and the cheeks less arcuate, so that the constriction behind eyes is less marked and the eyes less prominent. The interocellar bristles are short, less than half the length of the postero-lateral of the pronotum (approximately 40:90  $\mu$ ), instead of being approximately subequal as in *primulae*. The antennæ are slender, about 2.5 times the length of the head, and, though variable, are distinctive in their coloration; joint 2 shades from brown to yellow distally, 3 is yellow, 4 yellow in the basal fifth to half (0.2 to 0.5), and 5 pale in the basal fifth or thereabouts, this latter joint (5) being very much more slender and elongated than in *primulae* or *inconsequens*. The fore-wings are of a uniform brown except for the basal fourth or thereabouts; the lower vein is set with 15–16 setæ, whilst the distal half of the upper vein has a very inconstant series of setæ ranging from 3 to 6, and as variable in arrangement as in numbers, in this respect approaching *inconsequens*.

Abdomen with the posterior margin of tergite 8 fringed and the apical bristles rather long, much as in *primulae*.

Length (and breadth) of head, pronotum, and pterothorax 130 (170): 135 (222) and 380 (324)  $\mu$  respectively. Length

(and median breadth) of fore-wing 1.05 (0.08) mm. Length (and breadth) of antennal joints approximately :—

33 (32) : 46 (30) : 76 (25) : 65 (24) : 55 (20) : 66 (22) : 10 : 14  $\mu$ .

♂.—Smaller. Antennal joints 2 to 4 pale, 4 brown in the distal two-fifths (0.4) ; wings also paler and intermediate and hind femora and tibiæ pale basally and distally. Pale areas in abdominal sternites 3–7 much as in *primulæ*, but those on 6 and 7 markedly decreasing in size ; height (and breadth) of these areas from sternite 3 to 7 approximately 24 (82) : 22 (76) : 22 (79) : 24 (62) and 22 (52)  $\mu$  respectively.

A very distinct and apparently common species, with a wide range of host-plants.

*Hab.* ITALY, Portici (Napoli), on foliage of *Ficus*, *Quercus ilex*, *Genista* sp., and *Photinia elliptica*, iv. to vi. 1917 ; Atrio del Cavallo (Vesuvio), Resinia (Napoli) on *Robinia*, v. 1917 (*C. Minozzi*).

*Tæniothrips sodalis*, sp. n.

This is a small edition of *T. italicus*, from which species it also differs in the narrower head, the shorter fifth antennal joint, and shorter inter-ocular and pronotal setæ of both sexes, and in the shape and size of sternal areas in the abdomen of the ♂.

♀.—Length 1.15 mm.

Length (and breadth) of head, pronotum, and pterothorax 114 (146) : 114 (190) and 300 (240)  $\mu$  respectively ; length (and median breadth) of fore-wing 810 (60)  $\mu$ . Relative lengths (and breadths) of antennal segments approximately :—

27 (30) : 38 (27) : 65 (?) : 54 (?) : 41 (19) : 58 (20) : 8 : 13  $\mu$ .

The few examples before me have 1+1+1 setæ in the distal part of the upper vein of fore-wing in both sexes.

♂.—The male is much smaller also than the ♂ of *italicus*. Abdomen with the clear areas of sternites 3–7 transverse ovate, and thus differently shaped and much less broad than in either *primulæ* or *italicus*, but not so small as in *inconsequens* ; height (and breadth) of these areas approximately 19 (46) : 18 (43) : 17 (40) : 15 (35) and 13 (27) respectively.

*Hab.* ITALY, Portici (Napoli), rare, with *T. italicus* on foliage of *Ficus*, 31. v. 1917, and on *Genista*, iv. 1917 (*C. Minozzi*).

*Ctenothrips distinctus* (Uzel).

Known from Sweden, Finland, Holland, and Bohemia.

*Hab.* SWITZERLAND, Zurich, from near the summit of the Uetliberg, 1 ♀ on a grass (*Brachypodium*).

*Parafrankliniella verbasci*, Pr.

Known from England, Austria, Hungary, and Rumania, and probably a widely distributed species.

It occurs in flowers of *Verbascum*, and I have found it in SWITZERLAND, FRANCE (North and South), ANDORRA, and SPAIN, and have also received it from ITALY.

*Thrips herricki*, Bagn., 1926.

This species comes near *T. robustus*, Pr., from which it may be recognized by the normal form of the third antennal joint and the entirely yellow tibiae. I have only recently described it from the United States, where it was found on *Veratrum viride*. The European examples now recorded appear to have the sixth antennal joint somewhat shorter than in the original examples.

The following records are all from the flowers of *Veratrum album*:—FRANCE, Col de Puymérons, 5500 ft.; Font Romeu, 6000 ft.; L. Bouillouse, 6000 ft.; Val d'Eyne, viii. 26; ANDORRA, near the l'Hospitalet boundary. SPAIN, near Aja, viii. 26, ♀ ♀ only.

*Thrips dilatatus*, Uz.

*Hab.* FRANCE, Montlouis, at about 5200 ft., 3 ♀ ♀ and 1 ♂ by beating *Cistus*, viii. 26.

Previously known from North and Central Europe.

*Thrips robustus*, Pr.

Previously known from Austria and the Alps.

*Forma macroptera*.—Of several ♀ ♀ and 1 ♂ found together in the flowers of *Gentiana pyrenaica* all the ♀ ♀ are macropterous, whilst the ♂ is brachypterous. The ♂, previously unknown, is much as in the ♂ of *dilatatus*, having the large transverse areas of sternites and a series of four specialized setae on tergite 8 which are subequal in length.

In flowers of *Gentiana pyrenaica*.

*Hab.* France, Col de Puymoron, at c. 7000 ft., ♀ ♀, ♂; Val d'Eyne and SPAIN, near Nuria, viii. 26.

*Forma brachyptera*.—Specimens found in flowers of *Gentiana lutea* throughout the Eastern Pyrenees are, without exception, brachypterous females. Some of these differ in having the pronotal and abdominal setæ much longer than in the type, and might with advantage be named var. *pyrenaica*, nov.

*Hab.* FRANCE, Col de Puymoron, 5500 ft., and Font Romeu, 6000 ft.

*Var. pyrenaica*, m.

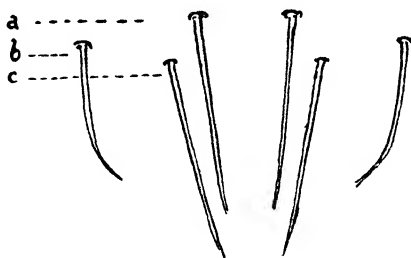
*Hab.* FRANCE, Font Romeu, 6000 ft., and L. Bouillouse, c. 6000 ft., viii. 26. ANDORRA, Soldeu road, c. 6500 ft., viii. 26.

*Thrips debilis*, Bagn. (Fig. 6.)

♂.—Length about 0·7 mm.

The specialized bristles on tergite 8 are arranged in a

Fig. 6.



Specialized seta of ninth abdominal tergite in ♂ *Thrips debilis*, Bagn.

distinctive manner. They consist of six bristles disposed in three planes; the pair on the median plane (marked *b* in fig. 6) are the most widely disposed (c.  $44\mu$ ), and are shorter than the others ( $19\mu$ ) and incurved; the pair on the highest plane (marked *a*) are the most closely spaced (c.  $12\mu$ ) and are long (c. 24 or  $25\mu$ ) and straight, whilst the third pair (marked *c*) are also straight and subequal in length to *a*, but more widely separated (c.  $19\mu$ ). The distance between *b* and *a*, *b* and *c*, and *a* and *c* are 15, 12, and  $9\cdot5\mu$  respectively.



This minute species was previously known from an unique ♀ specimen found in the Isle of Wight.

*Hab.* ITALY, Portici, on *Bignonia catalpa*, ♀ ♀, ♂, 16. vi. 1917 (C. Minozzi), Reg. 1030.

*Thrips frankeniæ*, sp. n.

♀.—Length 0·8–0·85 mm.

Yellow, legs pale, with femora greyish-yellow; antenna grey-brown, joint 1 pale, 2 and 3 inclined to be paler than the following in most specimens; fore-wings pale greyish-yellow. All setæ black, very short and stout to quite near apex.

Relative lengths (and breadths) of antennal joints 3–7:—

34 (15) : 31 (16) : 28 (16) : 34·5 (15) : 11  $\mu$ .

Pronotum with the setæ at the posterior angles much shorter and stouter than in any allied species, the outer and inner 17  $\mu$  and 22  $\mu$  long respectively, the longer only 0·24 the length of the pronotum.

Fore-wings with 19–22 costal setæ, hind vein with 9–11, upper part of fore-vein with 4+3 and distally with 1+1+1+1 (rarely 1+1+1) more or less equally spaced setæ.

Bristles of abdominal segment 9 52–64  $\mu$  in length as compared with 73–95  $\mu$  in *tabaci* and 108–122  $\mu$  in *montivagus*.

Readily recognized by the short, stout, dark setæ, the pronotal setæ being about 0·5 the length of those in *tabaci* and 0·36 the length of those in *montivagus*.

*Hab.* FRANCE, Perpignan, common on an aromatic shrub, *Frankenia laevis*, viii. 1926.

Superfamily **PHLÆOTHRIPOIDEA**.

*Haplothrips longipes*, sp. n.

♀.—Length 1·5 to 1·6 mm.; length (and breadth) of head and pronotum 195 (195) and ? 110 (270)  $\mu$  respectively; length of wings, hind tibia, and tube 690, 190, and 120  $\mu$  respectively; breadth of tube at base 60 and near apex 40  $\mu$ .

Light yellowish-brown, with considerable crimson hypodermal pigmentation, which is most concentrated in the thorax; femora and first antennal joints light brown; tibia pale yellow, with slight greyish-brown shading chiefly on

the outer margins and basally in the anterior and intermediate pairs and medianly in the posterior pairs. Antenna with joint 2 yellowish, shaded with light brown basally; joints 3 to 6 yellow, 5 and 6 with slight greyish shading and 7 and 8 light brown. Fore-wings hyaline distally, but very faintly fumate in the basal half.

Head practically as long as broad and at least 1.5 times as long as the pronotum, which is noticeably transverse. Mouth-cone reaching about two-thirds across the prosternum. Postocular setæ fine, blunt, and short ( $44\mu$  long), situated close to the hind margin of the eye. Antennæ scarcely more than 1.5 times as long as the head. Relative lengths (and breadths) of the antennal segments 2-8 approximately as follows:—

*H. heymonsi*, Karny (mm.). .035 (.02) : .045 (.02) : .045 (.02) : .05 (.02) : .043 (.015) : .037 (.015) : .02 (.01).

*H. longipes*, sp. n. ( $\mu$ ). 45 (29) : 49 (25) : 59 (31) : 54 (27) : 49 (25) : 43 (20) : 26 (12).

*H. flavitibia*, Will. ( $\mu$ ). 48 (31) : 52 (27) : 54 (29) : 56 (26) : 53 (24) : 49 (21) : 23 (14).

*H. knechteli*, Pr. ( $\mu$ ). — : 38 (24) : 46 (27) : 43 (23) : 38 (22) : 32 (20) : 22 (11).

Pronotum transverse, setæ near each hind angle about 0.5 the medium length of the pronotum, others shorter and less strong. Pteronotum large, quadrate, only slightly broader than long. Fore-wings with 9 duplicated cilia; subbasal bristles rather short, and the third but slightly longer than the others. Legs exceptionally long for the genus, fore-tarsus without tooth.

Tube short, about 0.6 the length of the head, apical hairs very fine, about as long as the tube; bristles on abdominal segment 9 about 0.75 the length of the tube.

♂.—More slender, the usual pair of spines on abdominal segment 9 slender, about  $33\mu$  long.

Of the known members of the genus *Haplothrips* possessing yellow tibiæ this species can only be compared with the European *heymonsi*, Karny (Turkestan, Transcaucasia), and *flavitibia*, Williams (England), and from both *longipes* would appear to be especially distinguished by the long and stout fourth antennal joint as compared to the third, and from the latter also by its long legs. The recently described *knechteli*, Priesner, is a smaller insect, and has the wings wholly

hyaline and the antero-lateral bristles of pronotum very long. *H. heymonsi*, a smaller species, has a more slender head than *longipes*, being 1·3 times as long as broad, measuring 0·17 (0·13) mm. In both forms the tube is approximately 0·5 the length of the head.

*Hab.* SPAIN, S. Esteban, 23. vi. 1912 (*Longinos Navas*).

*Haplothrips pineticola*, sp. n.

This species is closely related to *H. subtilissimus*, and has also a larva of the same type. It differs chiefly in its shorter head (which is actually somewhat broader than long), the longer tube, and the relative lengths of the antennal joints, joint 3 being distinctly shorter and 6 and 7 longer than in *subtilissima*.

The fore-wings are not so dark in the basal scale and base, whilst the subbasal setæ are markedly different in the two species. In *subtilissimus* these three setæ are separated by 27 and 19  $\mu$ , and in *pineticola* by 32·5 and 16  $\mu$ ; the third bristle is not present in the examples of *pineticola* before me, but 1 and 2 are subequal in length (40  $\mu$ ), colourless, slender, curved, and pointed, whereas in *subtilissimus* they are larger (46 and 49  $\mu$  respectively), dark brown, stout, and straight, with the ends dilated.

The relative lengths (and breadths) of the antennal joints 3–8 are as follows, the measurements in regard to *subtilissimus* being taken from one of a series of specimens from Surrey, England:—

*H. subtilissimus* (Hal.). 51·5 (26) : 57 (30) : 52 (27) :  
46 (27) : 41 (22) : 26 (12).

*H. pineticola*, sp. n. 43 (27) : 54 (30) : 52 (28) : 50 (25) :  
44–47 (22) : 27 (11).

Length of tube and breadth at base and at apex:—

*H. subtilissimus* : 122, 65, and 35  $\mu$  respectively.

*H. pineticola* : 132, 65, and 38  $\mu$  „

The prothoracic setæ are markedly shorter, lighter in colour, and less strong than in *subtilissimus*, the outer postero-angular being but 49  $\mu$  as compared with 62  $\mu$ .

On *Pinus* sp.

*Hab.* FRANCE, Font Romeu, Montlouis, and L. Bouillouse, at 5000–6500 ft., 4 ♀ ♀ and numerous larvæ; Val d'Eyne. SPAIN, nr. Aja, viii. 26.

## Genus CEPHALOTHRIPS, Uzel.

The type-species *monilicornis* (Reut.) has long been known and is widely spread in Europe, but has not yet been found in North America; a second European species (*hispanicus*, Bagn., known from Spain and the Himalayas) cannot be retained in this genus, and I have provisionally referred it to the genus *Malacothrips* (Ann. & Mag. Nat. Hist. ser. 9, vol. xiv. p. 635, 1924). Of the two American species Karny has selected *C. yuccæ*, Hinds, as the type of his genus *Bagnalliella*, whilst *C. errans*, Moulton, would appear to be properly placed; it differs from *C. monilicornis* in the structure of its antenna, in which the three terminal joints are not closely connate, whilst the whole antenna with the exception of joint 3 is dark brown in colour.

In view of the above, it is somewhat extraordinary to be able to describe two further undoubted species of the genus.

The following is a key to the European species, based on macropterous females:—

- |  |                                 |
|--|---------------------------------|
| 1. Fore-wings clear, duplicated cilia absent; antenna with joint 3 small and joints 6-8 closely united; fore-tarsus armed with a small tooth; terminal hairs shorter than tube .....   | 2.                              |
| Fore-wings coloured, duplicated cilia present; antenna with joints 3 and 4 broadest of all and 6-8 not closely united; fore-tarsus unarmed; terminal hairs as long as tube.  | <i>C. harrisoni</i> , sp. n.    |
| 2. Colour uniformly dark, bases of antennal joints 3-6, apices of tibiae, and all tarsi yellow; fore-coxal seta smaller ( $19\mu$ ); abdominal setae short, those on segments 7, 8, and 9 about 40, 40, and $54\mu$ respectively; terminal hairs about 0.6 the length of tube .....          | <i>C. monilicornis</i> (Reut.). |
| Colour otherwise, second antennal joint narrower; fore-coxal seta longer and stouter ( $30\mu$ ), with tip strongly dilated; abdominal seta also longer, those on segments 7, 8, and 9 about 40, 58, and $67\mu$ respectively; tube shorter and terminal hairs 0.77 the length of tube ..... | <i>C. coxalis</i> , sp. n.      |

*Cephalothrips coxalis*, sp. n.

♀.—Macropterous. Form much as in *C. monilicornis*. Colour (a somewhat teneral example) pale yellowish-brown, head and thorax darker than the abdomen excepting segments 8-10, which are darker than the head, and the tube

darkest of all; considerable heavy maroon hypodermal pigmentation, more especially down the sides of the abdomen. All legs pale, with the outer side of each tibia near base shaded with grey-brown, and more strongly so in the intermediate and hind pairs. Antenna with joints 1 and 2 and 7 and 8 grey-brown; 3 uniformly pale; 4 and 5 light grey-brown, pale basally, and 6 darker grey-brown and pale at extreme base. Wings clear.

Form as in *C. monilicornis*, but, apart from colour, at once distinguished by the characters given in the key. The legs are not so stout as in *monilicornis*, the tube is shorter, whilst the setæ (some are not discernible in the single example) appear to be longer and stouter throughout, with the apices strongly expanded as in *C. harrisoni*; the fore-coxal pair (almost vestigial in *C. monilicornis* and small in *C. harrisoni*) being especially noticeable. The basal antennal joints are smaller than in *C. monilicornis*, whilst joint 3 is claviform, with the inner margin straight and the outer only very gently curved. The measurements of the antennal joints are given in tabular form in the description of *C. harrisoni*.

Length (and breadth) of head 230 (184), of pronotum 108 (216), of pterothorax 298 (270), and breadth of abdomen 270  $\mu$ . Length, breadth at base and at apex of tube 122, 61, and 32  $\mu$  respectively; length of terminal hairs c. 94  $\mu$ .

In *C. moniliformis* the similar measurements are as follows:—Length (and breadth) of head 235 (193), of pronotum 122 (222), of pterothorax 296 (270), and breadth of abdomen 290  $\mu$ . Length, breadth at base and at apex of tube 148, 62, and 34 respectively; length of terminal hairs c. 82.

*Hab.* FRANCE, on the Mediterranean coast at Banyul-sur-Mer, viii. 1926, 1 ♀ beaten from a Carline thistle.

*Cephalothrips harrisoni*, sp. n.

Length about 1.7 mm.

Colour dark brown, fore-tibia light grey-brown except at apex, where it is pale creamy-yellow; intermediate and hind tibiæ of a darker grey-brown, pale basally and yellowish distally; basal joint of all tarsi yellowish. Antenna with joints 1 and 2 concolorous with head, 3 yellow, very lightly shaded with grey-brown distally; 7 and 8 of a uniform grey-brown; 4–6 grey-brown, 4 and 5 with the basal third or thereabouts and 6 with the basal fourth pale yellowish.

Fore-wing with scale-area light brown, clear in the second sixth or thereabouts, then brown except in the distal sixth, where it is clear; subbasal setæ pale, well developed, and dilated at tips.

Head massive, 1·2 times as long as broad; eyes dorsally occupying c. 0·35 the length of head; antenna about 1·5 times as long as the head, segment 3 claviform, 3 and 4 broader than any of the preceding or succeeding joints, 6-8 not so closely connate as in *monilicornis* and *coxalis*, sp. n. Relative lengths (and breadths) of the antennal segments in the three species as follows:—

*C. harrisoni*, sp. n. 27 (27):49 (32):68 (35):68 (38):  
52 (28):52 (27):44 (22):36 (13)  $\mu$ .

*C. monilicornis* (Reut.). 35 (32):54 (34):46 (29):54 (34):  
51 (32):49 (27):35 (25):30 (16)  $\mu$ .

*C. coxalis*, sp. n. 35 (27):49 (31):46 (26):49 (30):  
52 (29):41 (26):33 (23):26 (15)  $\mu$ .

Length (and breadth) of head 270 (218), of pronotum 162 (252), of pterothorax 338 (350), and breadth of abdomen 324  $\mu$ . Fore-wing 810  $\mu$  long and 63  $\mu$  broad near middle. Length, breadth at base and at apex of tube 162, 62, and 40  $\mu$  respectively; length of terminal hairs c. 162  $\mu$ .

The fore-wings have a series of eight duplicated cilia; the subbasal setæ are short and colourless (the first being shorter than the others) and form a broad-based triangle, the second seta (on a somewhat lower plane) forming the apex and situated closer to 1 than to 3.

This species, which I find pleasure in naming after my old friend J. W. H. Harrison, is readily distinguished by the characters given in the key.

*Hab.* FRANCE, Eastern Pyrenées, Orlu, near Ax-les-Thermes, viii. 26, 1 ♀ beaten from a cherry log.

*Phlæothrips bispinoides*, sp. n.

♀.—Length c. 1·9–2·0 mm.

Length (and breadth) of head 294 (286), of pronotum 162 (278), and of pterothorax 418·(486)  $\mu$ . Breadth of abdomen 472, length of tube 235, breadth at base 78, and breadth at apical constriction 40  $\mu$ ; length of terminal hairs 162  $\mu$ . Length (and breadth) of fore-wing 1012 (80)  $\mu$ .

Relative lengths (and breadths) of antennal joints approximately :—

41 (38) : 60 (35) : 90 (42) : 84 (43) : 77 (38) : 65 (34) :  
54 (29) : 40 (17)  $\mu$ .

Near *P. bispinosus*, Pr. Colour dark grey-brown, with considerable hypodermal pigmentation under reflected light; apices of fore-tibiae and fore-tarsus yellowish-grey brown, apices of hind tibiae and extreme apices of intermediate tibia paler than the rest of the leg. Antenna with joint 3 yellow, pale grey-brown distally, 4 and 5 grey-brown with basal third or thereabouts yellowish; extreme base of 6 pale; fore-wings lightly fumate, almost colourless distally. Setae pale, almost colourless.

The head is much as figured for *bispinosus*, but is approximately as broad as long, whereas it is 0.85 as broad as long in *bispinosus*. The characteristic subbasal genal spine is present in both species, whilst the post-ocular bristle, vestigial in *bispinosus*, is well developed and fully 0.5 the dorsal length of the eye. The antenna differs in several respects; joint 2 is stouter in *bispinoides*, being 0.8 as broad as 3, as compared to less than 0.5 the breadth in *bispinosus*, whilst it is markedly constricted before base; as compared to joint 4, joints 5–7 are longer than in *bispinosus*, and 8 is very markedly longer (40  $\mu$  as compared to 28  $\mu$ ), whilst 7 is noticeably narrower in *bispinosus* than in this species (24  $\mu$  as compared to 29  $\mu$ ); joint 7 is constricted at base to form a short stem.

The fore-wings have a series of nine duplicated cilia. The tube is longer compared to the head, being 0.8 the length of head in this species as compared to 0.62 the length in *bispinosus*.

The pronotal setae are present, stout, straight, colourless, and knobbed, the postero-angular pair are about 0.4 the median length of the pronotum, whilst the antero-angular are about 0.8 the length of the postero-angular.

Fore-tarsus with a sharp tooth.

The species undoubtedly approaches *P. bispinosus* very closely, but, even making allowance for the fact that that species is only known from the ♂, the differences in the antennal structure (notably the second and terminal joints), the short head and long tube, and the well-developed post-ocular setae make it impossible to refer this material to *bispinosus*.

*Hab.* SWITZERLAND, Zurich, by beating *Fagus* foliage, July 1925.

*Hoplandrothrips bidens* (Bagn.).

*Hab.* FRANCE, Orlu, near Ax-les-Thermes, 1 ♂ and several ♀ ♀ from a cherry log, with *Acanthothrips nodicornis* (Reut.) and *Cephalothrips harrisoni*, sp. n., viii. 1926.

*Liothrips brevicollis* (Bagn.).

Karny has rightly referred my *Cryptothrips brevicollis* to the genus *Liothrips*.

*Thorybothrips unicolor* (Schille).

1910. *Cryptothrips unicolor*, Schille.

1925. *Thorybothrips graminis*, Priesner.

A comparison of the actual insects demonstrates this synonymy.

*Cryptothrips tenuipilosus*, Bagn.

The insect was described from Corfu, but I have also seen an imperfect example from Crete (Herakleion, 25. v. 1906, leg. Biro).

LXXVI.—*A new Species of the Nematode Genus Syngamus.*  
By H. A. BAYLIS, M.A., D.Sc.

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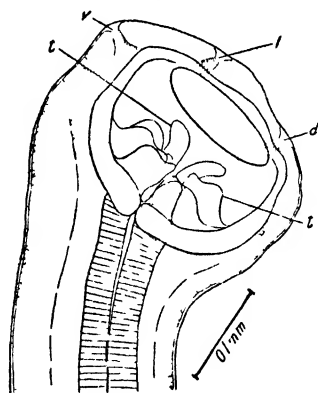
THROUGH the kindness of M. R.-Ph. Dollfus, the writer has had the opportunity of examining two pairs of individuals of a species of *Syngamus* collected by him from the trachea of a blackbird (*Turdus merula*) at Roscoff, Brittany. An exhaustive description cannot be given owing to the paucity of the material. Both pairs of worms were *in copula*, and it was necessary to remove one of the males in order to study the characters of the bursa. One of the female specimens was incomplete, the head having been broken off. Sufficient characters, however, can be made out to show that these worms are not *S. trachea* (Montagu) (= *S. trachealis*, v. Siebold), the common "gape-worm" of gallinaceous birds, nor do they appear to belong to any of the other species hitherto described from birds. The erection of a new species therefore seems to be necessary.



*Syngamus merula*, sp. n.

The worms closely resemble the common *S. trachea*, but are below the average size for that species. The males measure about 3·2 mm. in length, the female about 12·5 mm. The maximum thickness of the male is 0·25 mm.; that of the female 0·5–0·6 mm. The transverse striations are fine and faint. The greatest diameter of the head, in the male, is 0·28–0·3 mm.; in the female, 0·3 mm. The buccal capsule is without the annular thickening, externally to its anterior border, characteristic of *S. trachea*. In the female (fig. 1) it is fairly regularly cup-shaped or bowl-shaped, but in the males it is, relatively to its length, wider in front and

Fig. 1.



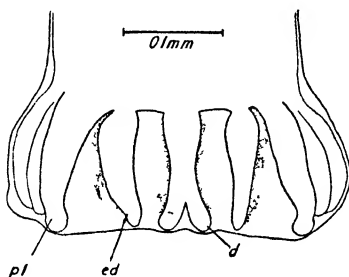
*Syngamus merula*. Anterior end of female; lateral view (slightly tilted).

*d.*, subdorsal papilla; *l.*, lateral papilla; *t.*, *t.*, teeth;  
*v.*, subventral papilla.

narrower behind, thus appearing more saucer-like in shape. In length the buccal capsule measures 0·12–0·13 mm. in the male and 0·14 in the female. Its greatest outside diameter is 0·24–0·25 mm. in the male and 0·23 mm. in the female. Its maximum internal diameter is 0·18–0·19 mm. in the male and about 0·2 mm. in the female. At the base of the buccal capsule there are eight relatively large, blade-like teeth. The distance from the anterior extremity to the end of the club-shaped œsophagus is about 0·7 mm. in the male and 0·9 mm. in the female. The nerve-ring is situated at 0·43–0·45 mm., and the excretory pore at 0·6–0·63 mm., from the anterior extremity.

The most important character of the bursa in the male (fig. 2) is the form of the dorsal ray, which is undivided for the greater part of its length, but bifurcate towards the tip, each branch being simple. In this respect the species

Fig. 2.

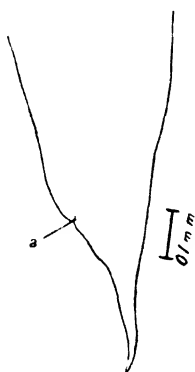


*Syngamus merulae*. Caudal end of male; dorsal view.

d., dorsal ray; e.d., externo-dorsal ray; p.l., postero-lateral ray.

resembles *S. parvus*, Chapin, 1925, and differs markedly from *S. trachea*, in which the dorsal ray is divided almost to the base, each half usually being tridigitate. The dorsal and externo-dorsal rays have the appearance of being surrounded by thickened sheaths of granular tissue. The

Fig. 3.



*Syngamus merulae*. Caudal end of female; lateral view.

a., anus.

spicules are very slender, and are unequal in length, the right spicule measuring about 0.08 mm. and the left 0.073 mm.

The tail of the female (fig. 3) tapers rather gradually to a

fine point, and measures about 0.35 mm. in length. The vulva is situated at about 2.5 mm. from the anterior end, in the single complete female specimen. The prevulvar portion of the body is relatively slender (of about the same thickness as the male worm), while the postvulvar portion is much distended by the genital organs. The eggs, which have operculate shells as in *S. trachea*, measure 0.09–0.095 mm.  $\times$  0.05–0.0525 mm.

As has been pointed out, this species differs from the common gape-worm of poultry (*S. trachea*), chiefly in the form of the buccal capsule and of the dorsal ray of the bursa. Five other species of *Syngamus* (as distinct from the closely-related genus *Cyathostoma*, E. Blanchard) have been recorded from birds, viz. :—

*S. coelebs*, Schlotthauber, 1860, from *Falco lagopus*.

*S. pugionatus*, Schlotthauber, 1860, from *Corvus pica* and *Sturnus vulgaris*.

*S. microspiculum*, Skrjabin, 1915, from *Phalacrocorax carbo*.

*S. parvus*, Chapin, 1925, from *Nucifraga caryocatactes*.

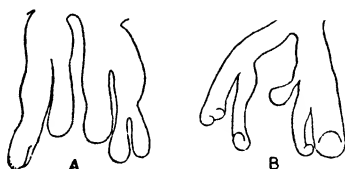
*S. gracilis*, Chapin, 1925, from *Corvus brachyrhynchos*.

The first two are *nomina nuda*, except for the mention of the hosts, and cannot therefore be taken into consideration here. In *S. microspiculum* the two branches of the dorsal ray are bifurcate, and the buccal capsule is said to contain only three small teeth. From both *S. parvus* and *S. gracilis* the present species differs in the much smaller size of its buccal capsule, especially in the female, and in the larger size of its eggs. From *S. gracilis* it differs also in the much more slender and pointed tail of the female and in the more posterior position of the vulva in the gravid female. It closely resembles that species, however, in the characters of the spicules of the male.

It is of interest to recall that a considerable number of wild birds have been recorded as hosts of *S. trachea*, and, in particular, the starling has been pointed to as an important factor in the spread of infection with this species among domestic poultry (Lewis, 1925, 1926). Lewis does not appear to have investigated the morphology of the specimens collected by him from wild birds, which included not only starlings, but the rook, thrush, and jay. Chapin (1925) wisely remarks that "it would seem desirable to compare more carefully than appears to have been done specimens of gapeworms that have been collected from various species of birds other than the Galliformes to determine whether they are really *Syngamus trachea*."

One further point may be mentioned here, in connection with the form of the dorsal ray in *S. trachea*. Chapin (1925), who based his description of this species on material from chickens and turkeys, figures two quite symmetrical tri-digitate branches of the dorsal ray, the middle terminal branch of each being narrower and shorter than the other two. It appears, however, that there may be considerable variation in this respect, since two male worms, taken at random by the writer from a collection from young pheasants, showed very marked asymmetry and irregularity of branching in the two halves of the dorsal ray (fig. 4, A & B).

Fig. 4.



*Syngamus trachea*. Dorsal rays of bursa of two male specimens, showing variation in form.

A is shown in dorsal, B in ventral view.

Though in both specimens three terminations of each branch can be distinguished, their form and mode of origin are very different even in the two branches of the same ray.

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- . 1926. Starlings as Distributors of "Gapes." *Ibid.* iv. 2, pp. 43-48.

LXXVII.—*Note on the Occurrence of "Cysticercus Tæniæ Grimaldii" in a new Host.* By H. A. BAYLIS, M.A., D.Sc.

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IN a former paper (1919) the writer has described a curious cysticercus from a dolphin (*Lagenorhynchus acutus*) found in British waters. This cysticercus was identified with the "*Cysticercus Tæniæ Grimaldii*" of Moniez, 1889.

Its most striking peculiarity is the possession of a very long "neck" coiled up within the "bladder" of the cysticercus, and bearing at its extremity the inverted scolex, which has characters agreeing with those found in adult cestodes of the genus *Monorygma*\*, occurring in Selachians.

Some cysticeri of a similar type have recently been received, which were collected from a Pigmy Sperm-Whale (*Kogia* sp.—? *K. breviceps*) at Trivandrum, South India. In these specimens the wall of the "bladder" does not attain to the same thickness as in those from *Lagenorhynchus*. It shows the same differentiation into two thick portions alternating with two thin portions, but the thick portions, in a specimen of average size, are only 1.1–1.2 mm. in thickness. In some of the specimens from *Lagenorhynchus* they were about 1.7 mm. thick. The scolex, though somewhat variable in shape, shows the same characters as in the *Lagenorhynchus* specimens.

At the time of writing the earlier paper referred to, the writer had overlooked a paper by Linton (1905) in which a similar cysticercus from the same host (*Lagenorhynchus acutus*) was described. It seems probable that Linton's species was the same as the writer's, although he does not appear to have connected it with the "*Cysticercus Tæniæ Grimaldii*" of Moniez. He does, on the other hand, express the opinion that it is specifically identical with the *Cysticercus delphini* mentioned by Rudolphi in his 'Entozoorum Synopsis,' and that this is different from the form described by him earlier under the same name in his 'Historia Naturalis.' This latter worm was first noted by Bosc in 1802, and is without the long invaginated "neck" characteristic of the cysticercus now under discussion. On the other hand, the *Stenotænia delphini* of Gervais, 1870, is, as the present writer has pointed out, closely similar to, if not identical with, *C. Tæniæ Grimaldii*.

\* Southwell, in his recent monograph of the Tetraphyllidea (1925), treats *Monorygma*, Diesing, 1863, as a synonym of *Phyllobothrium*, van Beneden, 1849, along with a number of other genera based upon the characters of the scolex. The species formerly attributed to *Monorygma* all possess a scolex with a very characteristic structure, quite different in appearance from that of *P. lactuca*, the genotype of *Phyllobothrium*. The writer may therefore be forgiven for not being quite in agreement with Southwell's statement, regarding *Cysticercus Tæniæ Grimaldii*, that "the most that can be said of this larva is that it probably belongs to the genus *Phyllobothrium*." It can further be said that it appears to belong to one of those species which have the *Monorygma* type of scolex, and this is an important limiting factor in attempting to determine the adult form to which it corresponds.

Linton proposed the name *Tænia chamissonii* for his cysticercus. Meggitt (1924) lists *M. chamissoni* (Linton, 1905), *M. delphini* (Gervais, 1870), and *M. grimaldi* (Moniez, 1889) as species of *Monorygma*, the two former being marked as doubtful. Linton mentions in his description of "*T.*" *chamissonii* that "the outer wall of the bladder is closely adherent to the inner wall of the cyst [*i. e.*, the cyst formed of the host's connective tissue], and the bladder itself is rather fragile in the preserved specimens." Perhaps there has been some confusion between the wall of the bladder proper and that of the connective tissue cyst, for Linton says of the "cysts" that "Their connective tissue walls are rather thick, and are dense, tough, and leathery. Upon opening one of them a slender filament, which may be as much as five or six times as long as the cyst, is seen attached to the inner wall."

In any case, there can be little doubt that *Cysticercus delphini*, Rudolphi (1819, *nec* 1810), *Stenotænia delphini*, Gervais, *Cysticercus Tæniæ Grimaldii*, Moniez, and *Tænia chamissonii*, Linton, are all extremely closely related, and possibly identical, forms.

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LXXXVIII.—*Observations made on the New Zealand Glow-worm (Arachnocampa luminosa) during 1926.* By G. V. HUDSON, F.E.S., F.N.Z.Inst.

SINCE sending in my summary of observations on the above insect, made some 35 years ago, I have had a number of the luminous larvæ under continuous observation from Dec. 14, 1925, up till the present time. These recent investigations entirely confirm the observations previously recorded, but one or two fresh facts have been elicited which appear worthy of mention.

The larvæ were obtained in the old locality in the

Wellington Botanical Gardens, the first batch on Dec. 14, 1925. These were placed in an inverted bell-glass, as previously, and were supplied, at irregular intervals, with small flies, but owing to my frequent absences from home little progress was made. About the middle of April, most of the larvæ being dead, I decided to start afresh. For this purpose a glass tank, one foot long by six inches broad and deep, was procured. A cardboard cover was fitted, provided with large ventilators guarded by means of fine wire gauze. A small opening with a stopper was also provided for introducing small flies to feed the larvæ. The bottom of the tank was covered with gravel, and several large irregular stones were arranged, one above the other, so as to form three or four miniature "caves." The gravel was saturated with water. Five healthy larvæ were introduced into the tank on April 21, 1926, and immediately constructed their characteristic webs, hanging suspended therein in the "artificial caves." At this time the larvæ were rather small, probably about half-grown. Small flies, mostly Mycetophilidæ, were regularly supplied every three or four days during the entire period, some half-dozen being introduced each time. These flies invariably disappeared, and on several occasions their remains were detected in the webs or on the surface of the stones close by. A *Julus*, which had been unwittingly introduced in the gravel, was also seen dead and entangled in one of the webs, but subsequently disappeared. This was on June 1, 1926. No vegetable matter was in the tank—nevertheless, the larvæ steadily grew. On June 20 one was observed to have pupated, the pupa hanging in the web suspended by the dorsal process as shown in the figure published in my last article. About a fortnight later this pupa disappeared, and it is possible that the imago may have emerged and fallen a victim to one of the other larvæ. On August 1 another pupa was observed, and this specimen is still alive, suspended in the usual way—a quantity of mucus, or possibly the old larval skin, is attached to the posterior extremity of this pupa. The tank being located in my bedroom, I have been able to observe the larvæ at all hours of the night. The light is, as previously stated, always brighter on dark warm damp nights, but it is invariably at its brightest immediately before daybreak. I have noticed this on many occasions. I consider my latest observations absolutely prove that the larvæ are carnivorous and that the light attracts, and the web entangles, the small flies on which the larva feeds.

There was, in fact, practically nothing else in the tank which could have sustained the larvæ during the three and a half months they have been in captivity, and the speedy disappearance of the numerous flies so frequently introduced further confirms this view.

As my primary object is to obtain authentic specimens of the perfect insect for the British Museum and for my own collection, I have so far refrained from disturbing either captive larvæ or pupæ for minute examination. Numerous specimens of the larvæ, taken at large when my supplies of larvæ were obtained, have, however, already been sent to Mr. F. W. Edwards at the British Museum, and these are, I understand, being investigated by a skilled microscopist, whose anatomical researches will shortly be published.

"Hillview," Karori, Wellington, New Zealand.  
August 12, 1926.

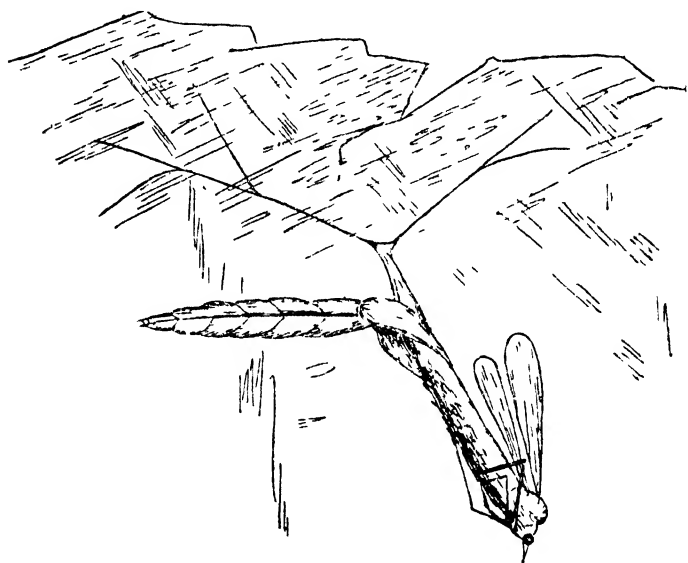
#### ADDENDA.

Shortly after the despatch of my last communication one of the captive larvæ made its way into the "cave" where the pupa was suspended and took up its abode in a web alongside. On several occasions I observed the head of the larva in contact with the pupa, but could not see if it was actually feeding on the same. During the last ten days, however, the pupa has gradually shrivelled up and it is now almost an empty skin, the larva having increased in size during the same interval. It is clear that the larva has fed upon the juices of the pupa, and, from the very close proximity in which we always find the glow-worms in a state of nature, it is practically certain that these cannabilistic habits must at times occur under natural conditions. I have now three healthy full-grown larvæ in the tank, and as they are situated at some distance from each other I may yet succeed in rearing the imago. The larvæ have been in captivity during the whole of the winter, *i. e.*, from April 21 until the present time, August 28.

*September 12.*—One of the larvæ has now changed into a fine healthy pupa, apparently likely to emerge very shortly. This pupa has no larval skin, or mucus, attached to its posterior extremity. None of the pupæ observed during the winter of 1926 (April to September) have so far exhibited any luminosity. This may be due to the cold.



*September 26.*—Since my note of the 12th instant the pupa referred to has, at irregular intervals, emitted a strong light from its posterior extremity. On the morning of September 24 the perfect fly emerged, a ♀. During emergence the pupa assumes an almost horizontal position, and as the imago protrudes from the pupa its head comes downwards, the thoracic attachment of the pupa acting as a fulcrum. First, the wings are drawn clear, afterwards the legs. In the final stage of emergence, of which I enclose a sketch made by my daughter (see fig.), the head of the imago is directed downwards, the tail of the pupa pointing slightly



upwards, the pupal attachment occupying an intermediate position. When finally clear the imago stands on the pupal skin, with the extremity of its abdomen still within the exuvia, the pupal skin resuming its original vertical position.

At 4 P.M. on the 24th I detached the exuvia from the rock, and removed it and the perfect insect into a small caterpillar cage. During the ensuing night the anal extremity of the fly was observed to be strongly luminous and apparently continuously so. The fly died the next day. Both pupal skin and imago are being sent to the British Museum.

## BIBLIOGRAPHICAL NOTICES.

*British Birds.* Vol. IV. By A. THORBURN. Pp. 154, 50 plates.  
Published by Longmans, Green & Co.

WE congratulate Mr. Thorburn on having now completed his beautiful work on *British Birds*. The present volume contains the *Limicolæ*, *Gaviæ*, and *Alcæ*. The plates are fully up to the high standard Mr. Thorburn set himself when he began his work; every plate is a beautiful picture, yet, in spite of this, he has not sacrificed accuracy for effect, and the would-be ornithologist will have no difficulty in distinguishing and identifying his birds so long as he keeps to their pictorial representations. Occasionally, like everyone else who has his paintings reproduced, Mr. Thorburn has suffered from the slight imperfections natural to every reproducer and to every form of reproduction. For instance, we may mention the beautiful pink glow on the under surface of the black-headed gull on plate 164, a colour which never existed in Nature, and, equally certainly, would not be found in the original painting.

When we turn to the letterpress, we find this to be in almost every way satisfactory. Mr. Thorburn has succeeded in briefly summing up the salient features both of the bird itself, its habitat, and its habits, and although it is not easy for an ornithologist of the present day to tell us much, or anything, about our British birds that is new, the author's personal notes are always interesting and worth recording.

The great blemish to all four of these volumes has been the prehistorical nomenclature adopted. Perhaps because our waders form such a favourite group both amongst field-naturalists and amongst those who work in museums, much work, in comparison with the other groups, has been carried out in this one during the last few years and Dr. Lowe and other scientists have taught us a great deal about their classification which was formerly unknown. In spite of this, Mr. Thorburn has adhered to the nomenclature in common use amongst our fathers and, in consequence, his scientific names will convey little or nothing to the student of to-morrow, whilst it may well be a source of great inconvenience and confusion. We would also suggest that Mr. Thorburn, with his deep prejudice against egg-collectors, whether scientific or the reverse, is hardly fair to either class when he insinuates that the extinction of the great auk is due to the frenzied collecting of its eggs, or when he suggests that the bar-tailed godwit has been driven from the shores of Norfolk by the egg-collecting fiend. In the former case it is probable that the bird's unsuitability to modern surroundings and its defencelessness against its enemies, man or animal, were the

causes of its final disappearance, whilst, on the other hand, the godwit has left England merely because cultivation and the advance of agricultural needs have altered the conditions of the greater portion of their breeding-area. In spite, however, of these faults in the four volumes there are few British ornithologists who will not desire to have this work upon their book-shelves, and the author may rest content that his reputation as an artist, great as it is, has in no way suffered through the production of this book.

*The Natural History of the Oxford District.* Contributions edited by JAMES J. WALKER, R.N., Hon.M.A., F.L.S. Pp. viii & 336, with map. Oxford University Press, 1926.

THIS work was prepared by the Local Publications Committee for the Oxford Meeting of the British Association, 1926. It deserves special notice, the portions devoted to Geology, Botany, Ornithology, and Entomology being of permanent value to naturalists generally, whether resident in Oxford or elsewhere. The Entomology (pp. 161-298) has been contributed by various well-known workers, and the analysis given of the Coleoptera and Macro-Lepidoptera found within a radius of seven miles of the city is of real interest to all students of the subject. The number of species of beetles now recorded from the district is given in tabulatory form by J. J. Walker (p. 191) as 2120 out of the 3570 for the whole of the British Islands, equalling 59·3 per cent. Mr. Waters, too, in a similar way (p. 247), gives totals for the Micro-Lepidoptera, 737 out of 1325, equalling 55·7 per cent. Preliminary lists of the Coleoptera by the editor have been issued from time to time, 1906-1920, in the 'Reports of the Ashmolean Natural History Society of Oxfordshire,' the first (1906) including 1399 species, with additions in each of the five supplements, showing that 721 have been added during the past twenty years, mainly due to the continual activity of Commander Walker and Mr. J. Collins.

"The Botany of the Upper Thames," by G. Claridge Druce (pp. 72-127), "The Geology of the Country round Oxford," by Prof. W. J. Sollas, K. S. Sandford, and W. J. Arkell (pp. 32-71), "The Birds of the Oxford District," by the Rev. F. C. R. Jourdain (pp. 128-160), and the "Land and Fresh-water Mollusca of the Oxford District," by the Rev. L. W. Grensted (pp. 304-312), &c., are also valuable contributions to this neatly printed compact little volume, prepared for gratuitous distribution to the members attending the Association Meeting.

## PROCEEDINGS OF LEARNED SOCIETIES.

## GEOLOGICAL SOCIETY.

May 19th, 1926.—Dr. F. A. Bather, M.A., F.R.S.,  
President, in the Chair.

The following communications were read :—

1. 'A Revision of the British Carboniferous Murchisoniidae; with Notes on their Distribution, and Descriptions of Some New Species.' By Jane Longstaff (*née* Donald), F.L.S., F.G.S.

Reference is made to the genotype, *M. turbinata* Schlotheim, and figures are given of the aperture of two species in De Verneuil's Collection, Paris, showing the characteristic slit in the outer lip.

Six new species and one variety are figured and described, as well as five species recorded by L. G. De Koninck in Belgium, which, with one exception, had not been previously noted in the British Isles.

The holotypes of all the species are indicated, and the collections in which they are placed; also additional localities are given.

Altogether fifty-two species and one variety have been recorded, which are referable to five other genera and subgenera besides *Murchisonia* *sensu stricto*. The greater number belong to the genus *Hypergonia*, of which the distinctive characters are especially pointed out, as they are clearly exhibited in well-preserved Scottish examples, some of which are almost complete from apex to aperture.

Seventeen species are common to Belgium, all of which are Viséan except three, two being Tournaisian and one Waulsortian.

Scotland has the most species; and so far twenty appear to be peculiar to that country, nine to England, and one to Ireland.

The greater number of British species are of *Dibunophyllum* age, only eight being from lower and two from higher zones.

2. 'The Carboniferous Limestone (Avonian) Succession of a Portion of the North Crop of the South Wales Coalfield.' By Thomas Neville George, M.Sc.

A description is given of the lithological and faunal succession of the Avonian along some 30 miles of the North Crop between Kidwelly and Penwyllt (Tawe Valley). The general succession is as follows :—

Millstone Grit.		Thickness in feet.
Unconformity.		
D <sub>2</sub> D <sub>3</sub> {	Upper Limestone Shales. Shales, with impure limestones weathering to rottenstone .....	0-20
Main Limestone.		
D <sub>4</sub> {	Dark limestones of various types: east of the Kidwelly district they are associated with grits, thin quartzites, and abundant cherts. ....	0-250
D <sub>1</sub> {	Pale-grey oolite. A coarse oolite, with a sandstone (the Honeycombed Sandstone) at the base .....	40-70
S <sub>2</sub>	Limestones and oolites, with much pisolite .....	300-350
<i>Ann. &amp; Mag. N. Hist. Ser. 9. Vol. xviii.</i>		45

## Unconformity.

K	Lower Limestone Shales. Shales, with thin limestone	.....
---	---	-------

Thickness  
in feet.  
15-100

## Unconformity in places.

## Old Red Sandstone.

The Main Limestone presents several interesting features. It is much attenuated, when compared with other areas, being about 500 to 600 feet thick. This is due to the following reasons:—

- (1) An intra-Avonian unconformity, marked by the absence of the zones of Z (possibly K<sub>2</sub>) to S<sub>1</sub>, is present. It is probable that deposition recommenced early in S<sub>2</sub> times.
- (2) The zones which are present are probably condensed, owing to intermittent deposition.
- (3) In parts, overstep by the Millstone Grit cuts out some of the upper beds.

The Middle *Dibunophyllum* Zone is represented by two facies, which appear to have been deposited in more or less separate areas. That seen near the Kidwelly district consists of standard limestones yielding a normal fauna, and is comparable with beds of the same horizon in Gower, Pembrokeshire, Bristol, etc. The other consists of impure sandy and cherty limestones, with some calcite-mudstones, and a fauna chiefly composed of molluscs and Productids. As this facies is traced eastwards towards Llandeby it becomes more normal. The two areas of deposition were presumably separated by a barrier resulting from an earth-movement in D times. This is indicated by overstep of the Millstone Grit in the district separating the two facies, where the greater portion of the *Dibunophyllum* Zone is absent.

It is evident that, throughout Avonian times, the area was subject to periodic earth-movements, evidence of some of which has been found in Gower and Pembrokeshire by Mr. E. E. L. Dixon. The effects of these movements are clearly seen in the area described, owing to its proximity to the Avonian shore-line.

June 9th, 1926.—H. W. Monckton, Treas.L.S.,  
Vice-President, in the Chair.

The following communications were read:—

1. '*Naos pagoda* (Salter): the Type of a New Genus of Silurian Corals.' By William Dickson Lang, M.A., Sc.D., F.G.S.

The detailed structure of the hitherto-overlooked species *Ptychophyllum pagoda* Salter is described and figured; it is found to be intermediate between *Ptychophyllum* and *Chonophyllum* (in their proper interpretation), and the new generic name *Naos* is proposed.

*Ptychophyllum*, *Chonophyllum*, and *Mucophyllum* are interpreted by their genotypes, and figured; and the septal secondary thickening of the last two, and of *Naos*, is compared with that occurring in some other Silurian lineages.

2. 'The Junction-Bed of the Middle and Upper Lias on the Dorset Coast.' By James Frederick Jackson, F.G.S.

This paper embodies the results of the Author's work on the Junction-Bed of the Middle and Upper Lias, near Eypesmouth on the Dorset coast, during 1921-25.

Deposits of *Harpoceratoides hemera* have been traced throughout the 'Western Cliffs'.

A richly-fossiliferous representative of part of the 'Transition-Bed' of the Midlands has been found at Doghus Cliff.

Some marked examples of non-sequence between the *paltus* and the *spinatum* layers are described.

Details are given of a compact limestone crowded with well-preserved fossils in the marlstone at Thorncombe Beacon. It appears to be transitional from the sandy clay below the Junction-Bed, but reasons are advanced for thinking this to be a case of pseudo-sequence due to deposition on a sea-bottom of incoherent materials.

Attention is directed to certain sections of the Junction-Bed showing less than 12 inches of stone between the Down-Cliff Clay and the Thorncombe Sands.

All the cephalopoda and brachiopoda found by the Author in the 'Western Cliffs' are tabulated.

The correlation of the several layers in the Junction-Bed is shown by a table of certain sections measured in the 'Western Cliffs' and Watton Cliff.

Evidence having been obtained by the Author that former descriptions of the Junction-Bed ('Watton Bed') required emendation, excavations were made at Watton Cliff, and the strata were measured and photographed *in situ*. It was established that the ascending sequence in the Watton Bed is: (1) finely-laminated lithographic limestone, with early Hildoceratids; (2) massive lithographic limestones, with *Grammoceras* and *Hammatoceras*; (3) redeposited *thorncombiensis* material; (4) massive limestone. Non-sequences separate divisions (1) & (2), and (2) & (3). It is claimed that these results remove the anomaly of the seeming occurrence of early Hildoceratids above strata with *Grammoceras* and *Hammatoceras*; the Hildoceratids are in proper order at the base of the 'Watton Bed'. The finely-laminated lithographic limestone was not previously visible *in situ*, and to this fact must be attributed the misunderstandings that have arisen concerning the true sequence in the 'Watton Bed'. The Author's views on the formation of the 'Watton Bed' are outlined, emphasis being laid on the total absence of redeposited materials in the finely-laminated lithographic limestone—all the evidence indicating slow accumulation under perfectly tranquil conditions. The massive lithographic limestones contain redeposited matter, and were formed under much less tranquil conditions.

3. 'A Contribution to the Geology of the Eastern Part of the Denbighshire Moors.' By Prof. P. G. H. Boswell, D.Sc., F.G.S.

The present paper is a first contribution to the revision of the geology of the Denbighshire moors. It deals with the eastern part of the area, about 72 square miles in extent, between Llanefydd, Denbigh, Ruthin, and the centre of the moors.

After describing the work of Sedgwick, Ramsay, and other former investigators in the area, the Author gives a detailed account of the stratigraphical succession and faunal sequence, and comparison is made with the neighbouring areas of the Clwydian Range, the Llangollen area, and the district of Cautley and Ravenstonedale.

The greater part of the area consists of Upper Salopian strata, comprising rocks belonging to the zones of *Monograptus nilssoni*, *M. scanicus*, and *M. tumescens*, but the succession is much obscured by a thick mantle of Glacial Drift. For assistance in determining the sequence of the beds, the key to which is furnished by the graptolite fauna, the Author is greatly indebted to Miss G. L. Elles, D.Sc.

Microscopic examination of the sediments has shown that they are all of shallow-water facies, varying from sandstones of medium grain to siltstones and mudstones which often contain bands of very fine material. Even in the latter, however, coarser grains of quartz occur sporadically. On the whole, the deposits increase in coarseness as they become younger, and this is attributed to the filling-up and shallowing of the geosyncline; while minor alterations in the grade-characters are attributed to current action, although they may be the result of slight oscillatory earth-movements.

The rhythmical banding of the Nantglyn Flags suggests periodicity, possibly seasonal in character.

Tectonically, the area constitutes the north-eastern part of the syncline of the Denbighshire moors, pitching north-eastwards. It is, moreover, intensely faulted, and nowhere is a continuous sequence of the zones visible. The dominant faults are of north-and-south trend, but swing north-north-westwards in the northern part of the area, and apparently south-south-westwards south of the district. The structure is interpreted as the result of successive upthrows towards the west, but some lateral movement is probable.

Numerous cross-faults, usually antedating the north-and-south faults, carve the country into blocks.

While much of the faulting is of pre-Carboniferous age and related to the folding, movement on the north-and-south faults was, at least in part, renewed in post-Carboniferous times.

The rocks in the central part of the area have been subjected to intense crushing and shearing.

Cleavage is general throughout the district, and is related in direction to the Caledonian folding.

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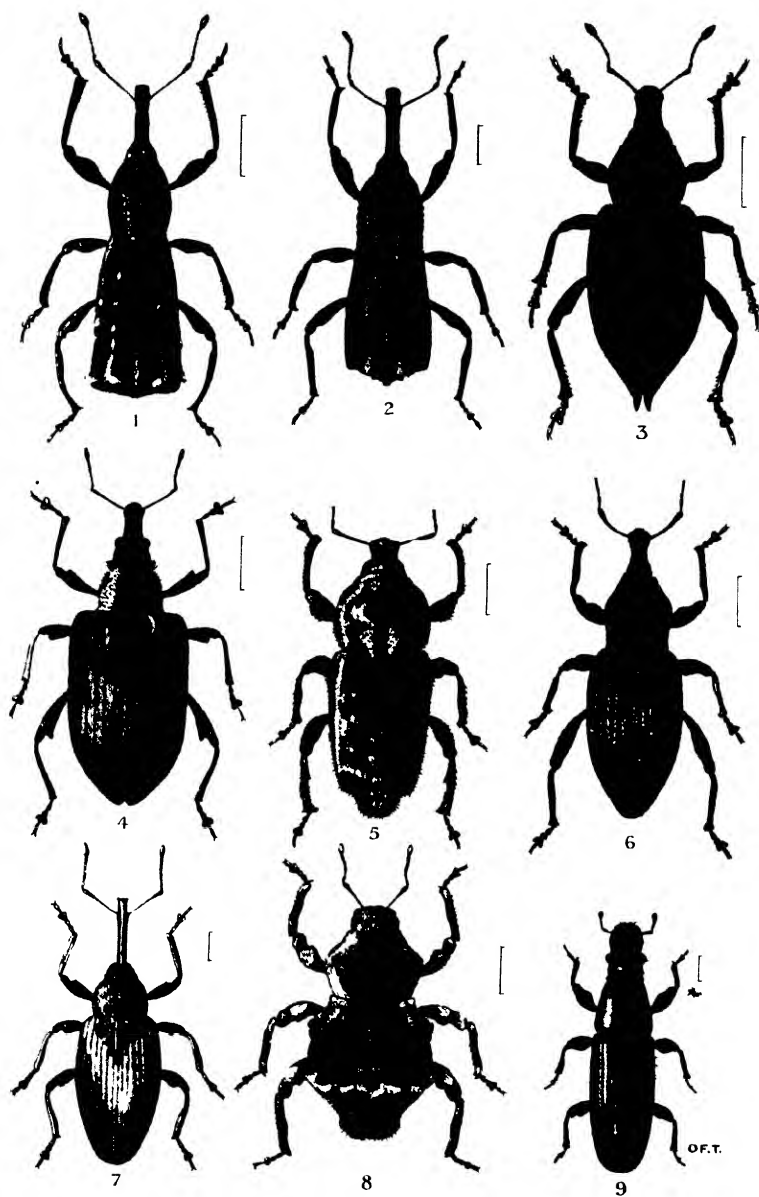
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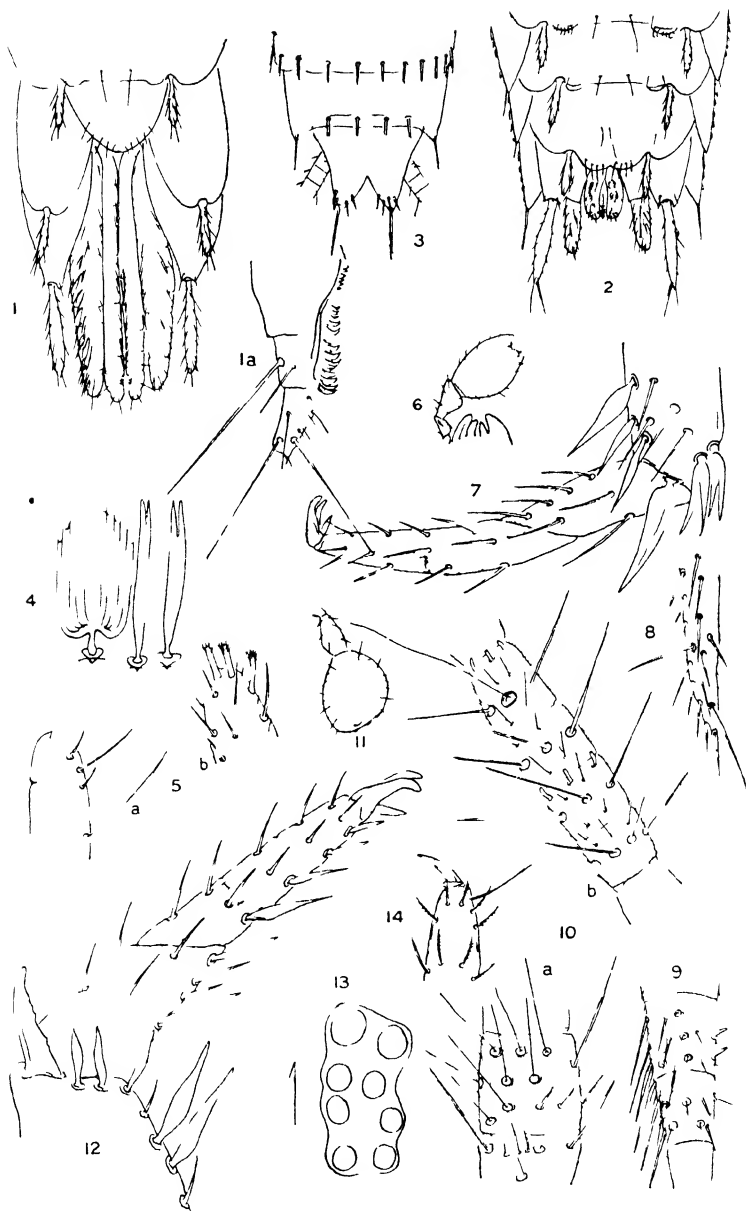
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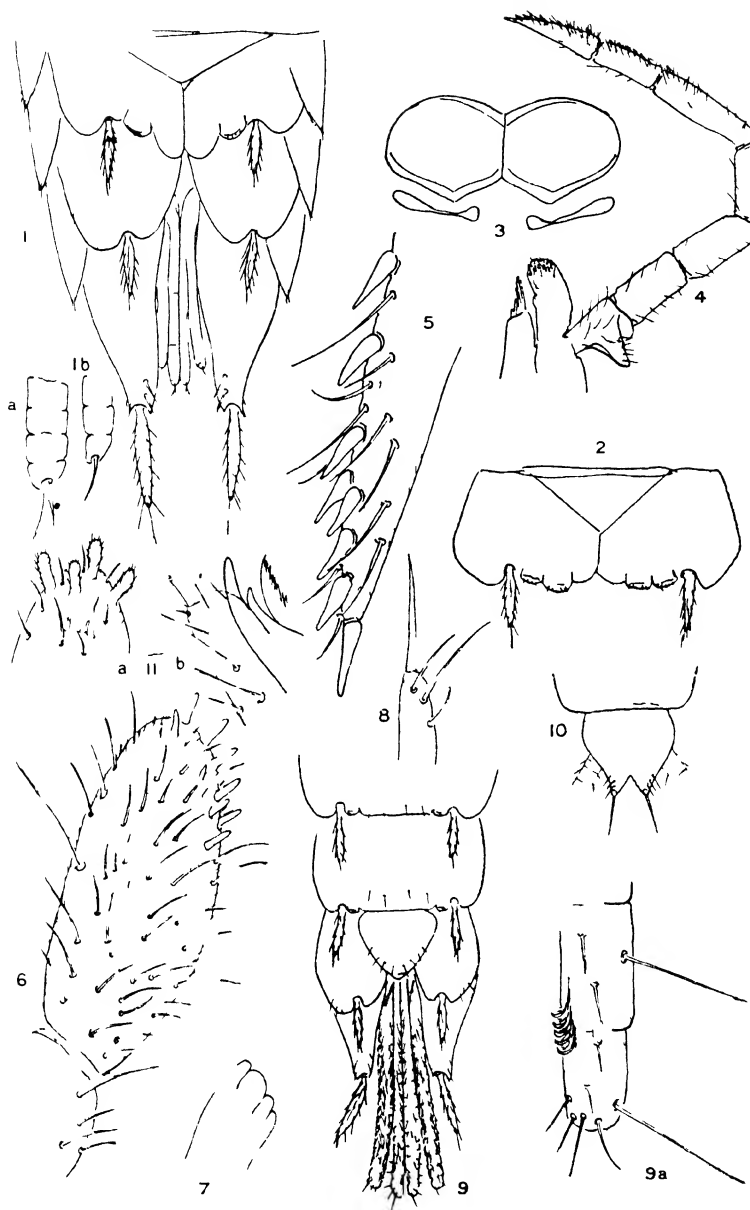


J. M. B. del.

African Apterygota







J. M. B. del.

**African Apterygota.**

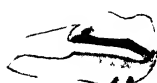




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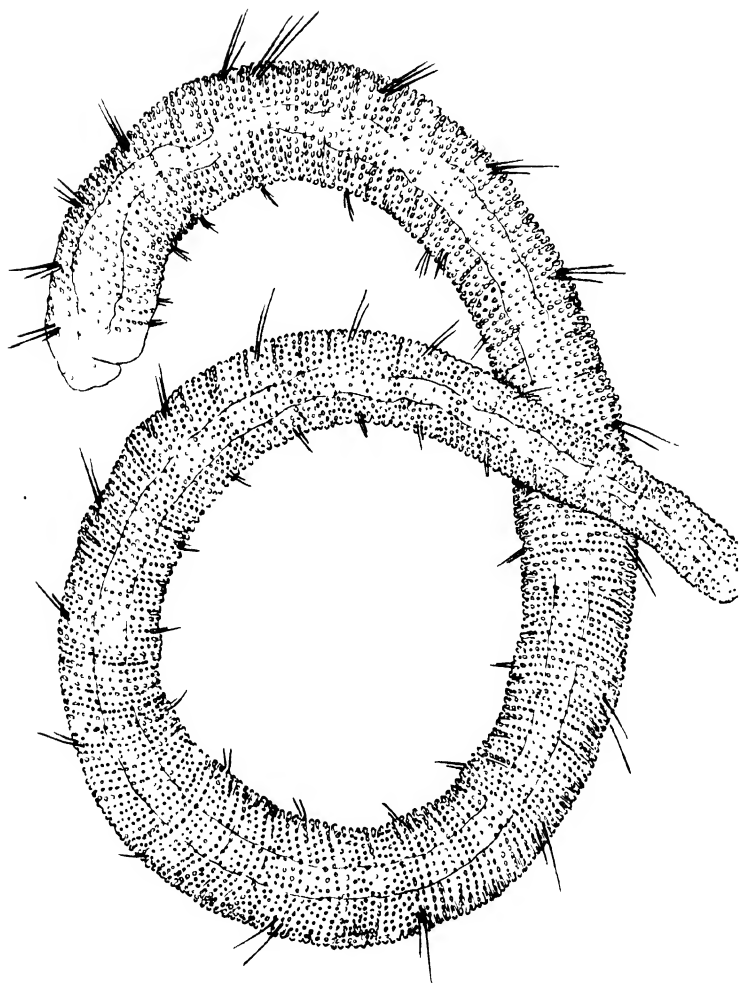
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OTOLITHS OF JURASSIC FISHES



FIG. 1.



*Naidium(?) trivandranum*, sp. n.



FIG. 2.



FIG. 3.

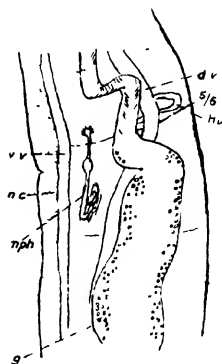


FIG. 4.

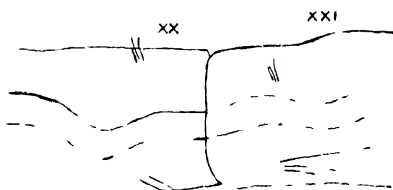


FIG. 5.

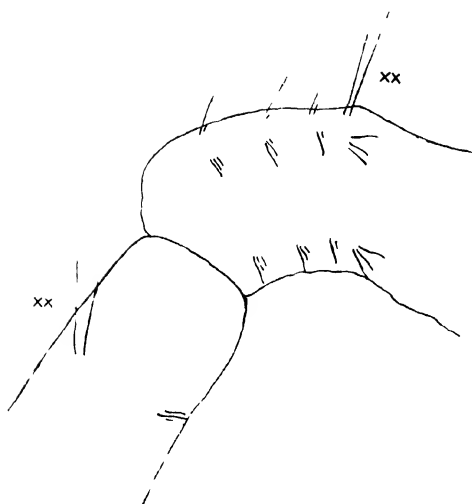
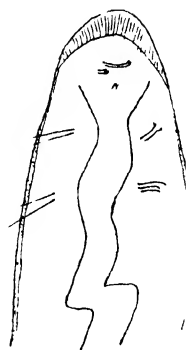


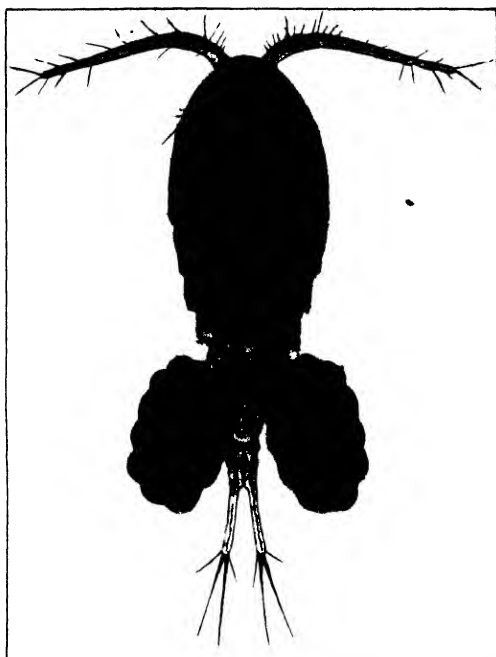
FIG. 6.



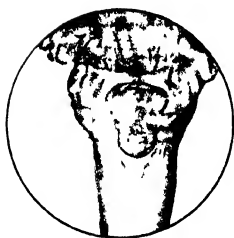
*Naidium(?) trivandranum, sp. n.*



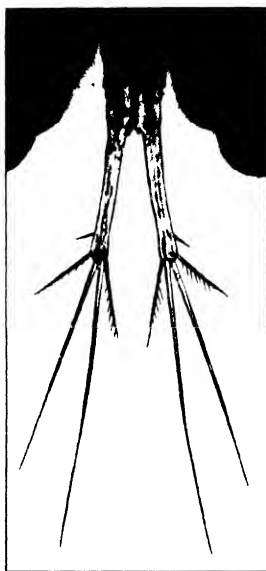




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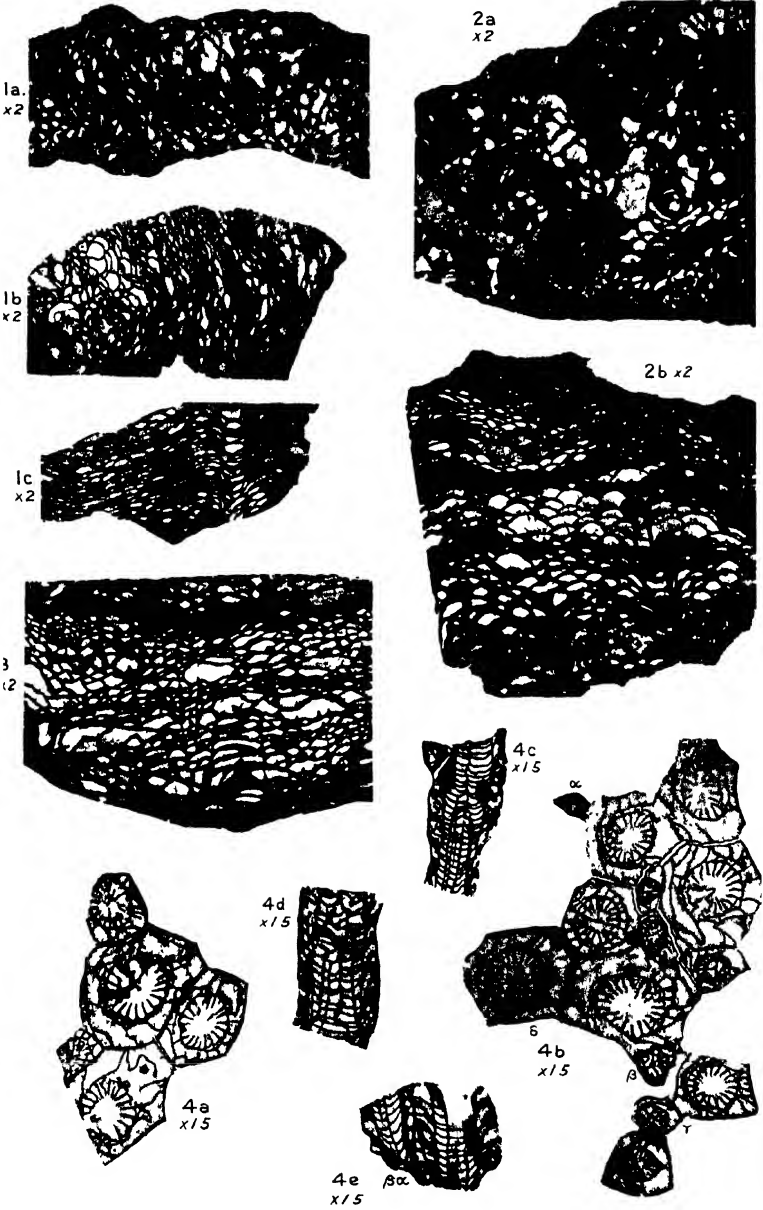


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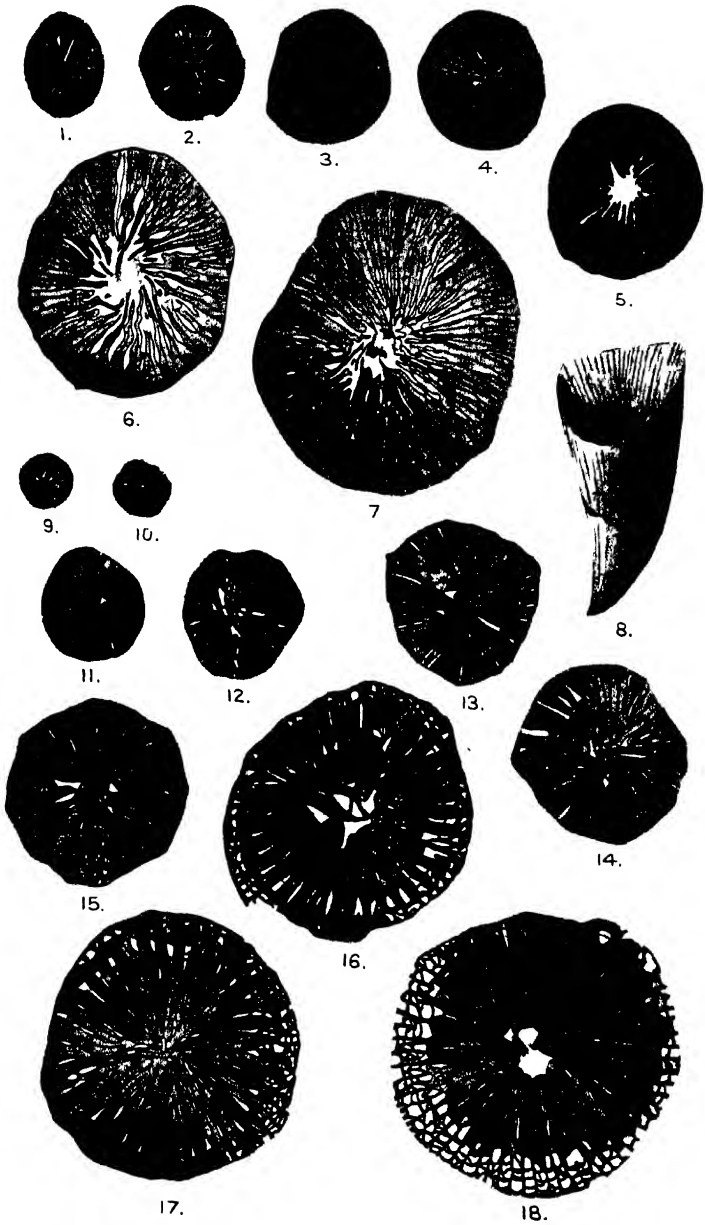
3





ORIONASTRAEA INDIVISA & THYSANOPHYLLUM PRAEDICTUM, spp nov

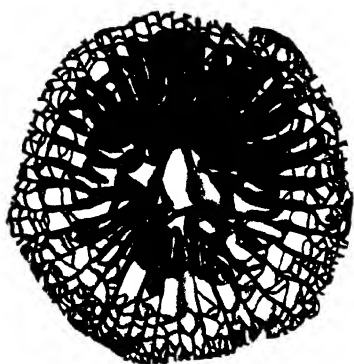




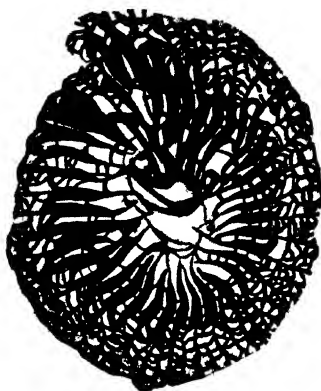
T A. R. del.

PYCNACTIS gen. nov. & MESACTIS gen. nov.

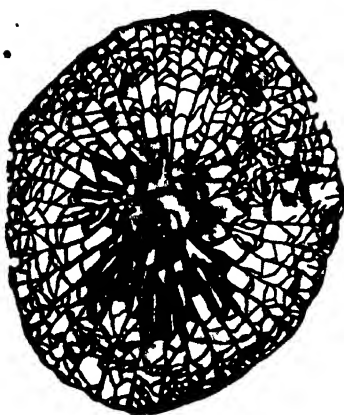




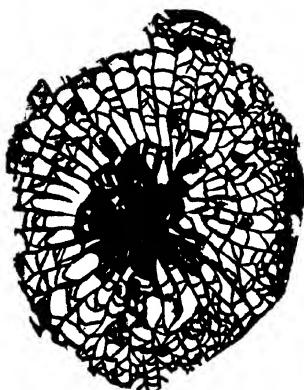
1.



2.



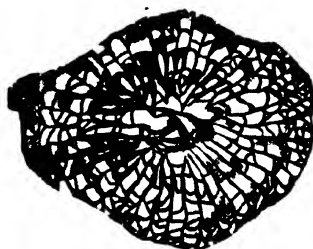
3



4.



5



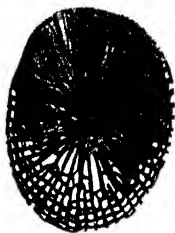
6.

T A R del

MESACTIS gen nov.







1



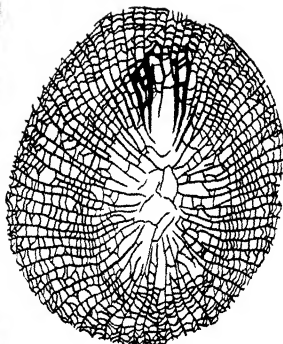
2.



6.



3.



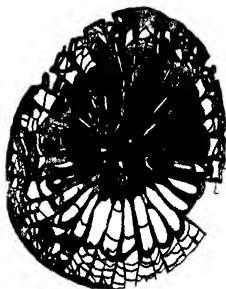
4.



5.



8.

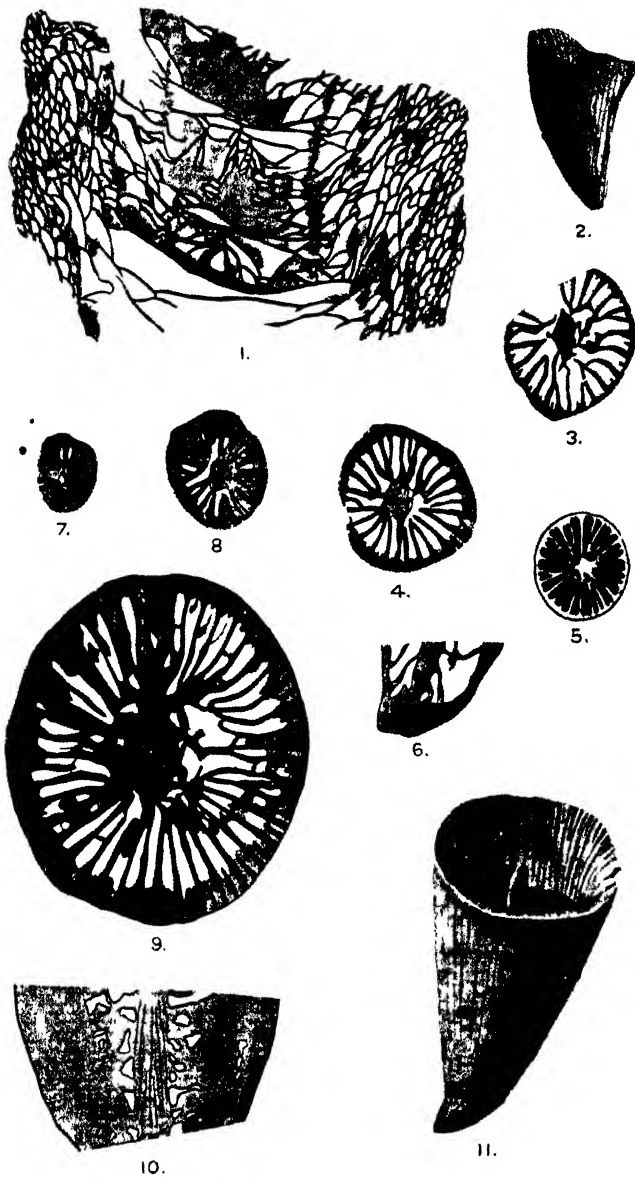


7.

T A. R. del

PHAULACTIS gen nov.

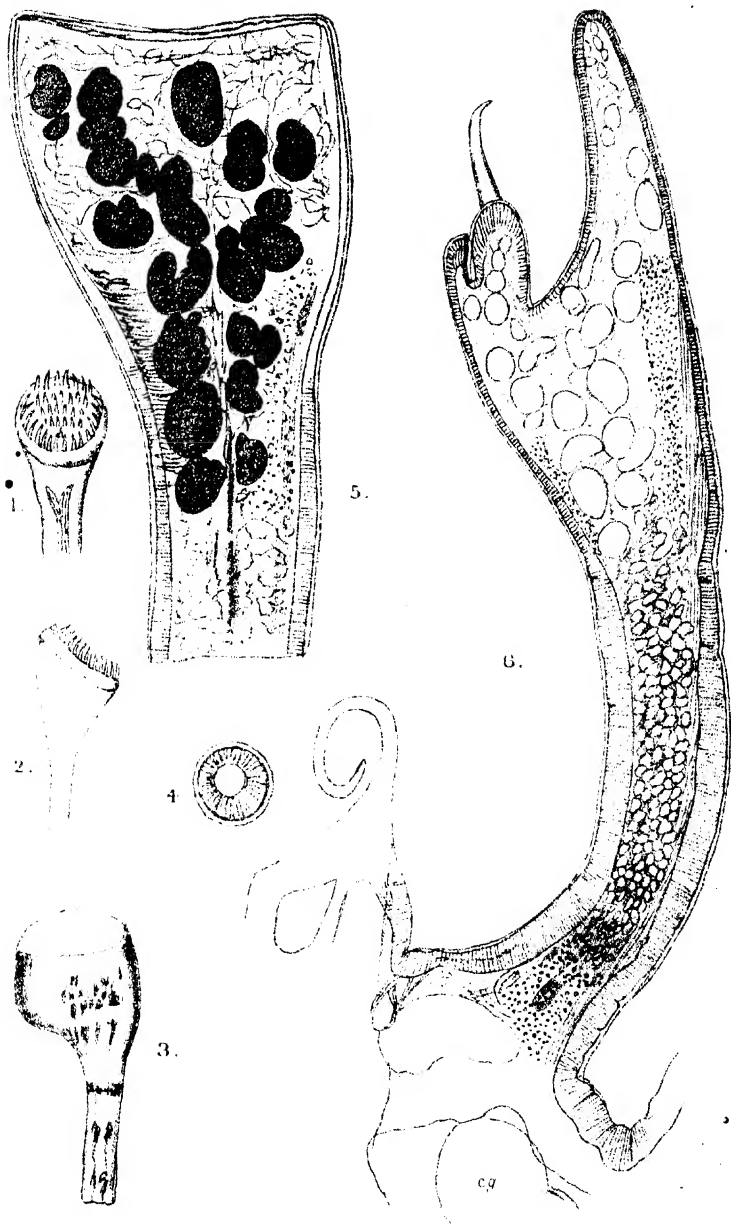




T A R del

PHAULACTIS gen.nov. & DINOPHYLLUM Lindström.



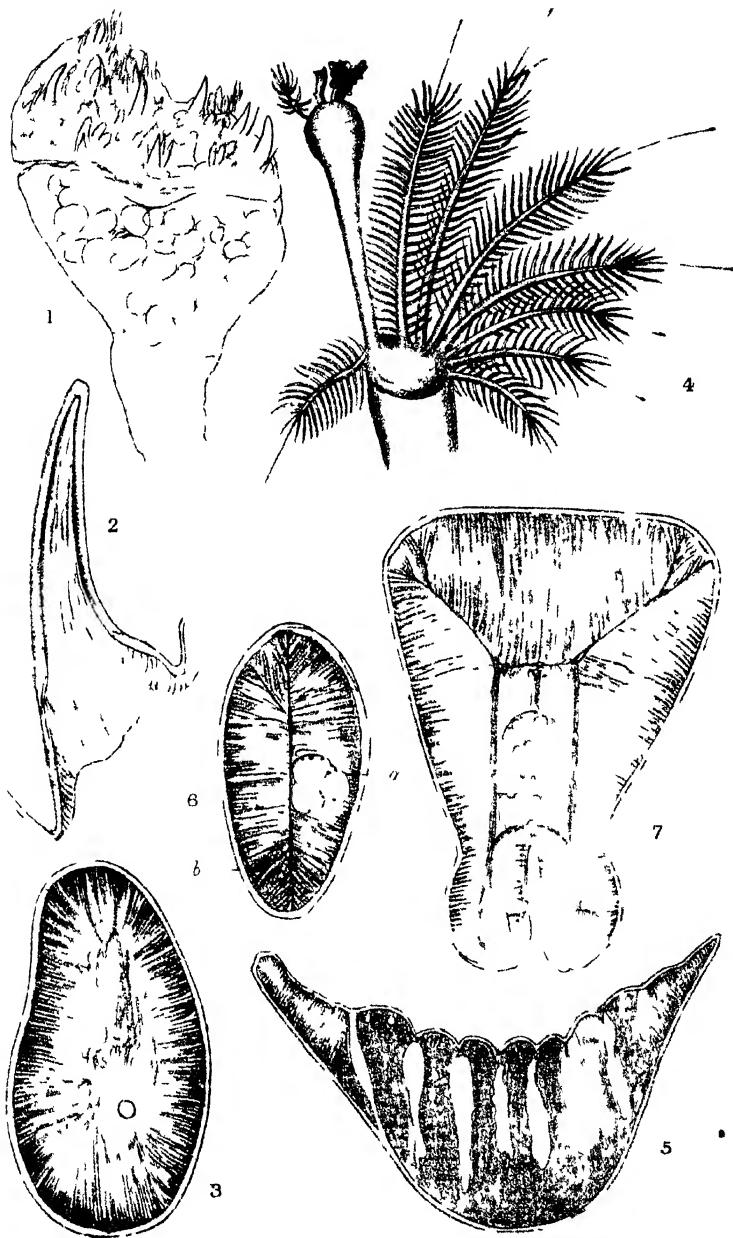


W.C.M. del.

Huth lith. et imp.

1, 2. Opercula of *Mercierella* and sections (4, 5, 6). *Ficopomatus* (3).





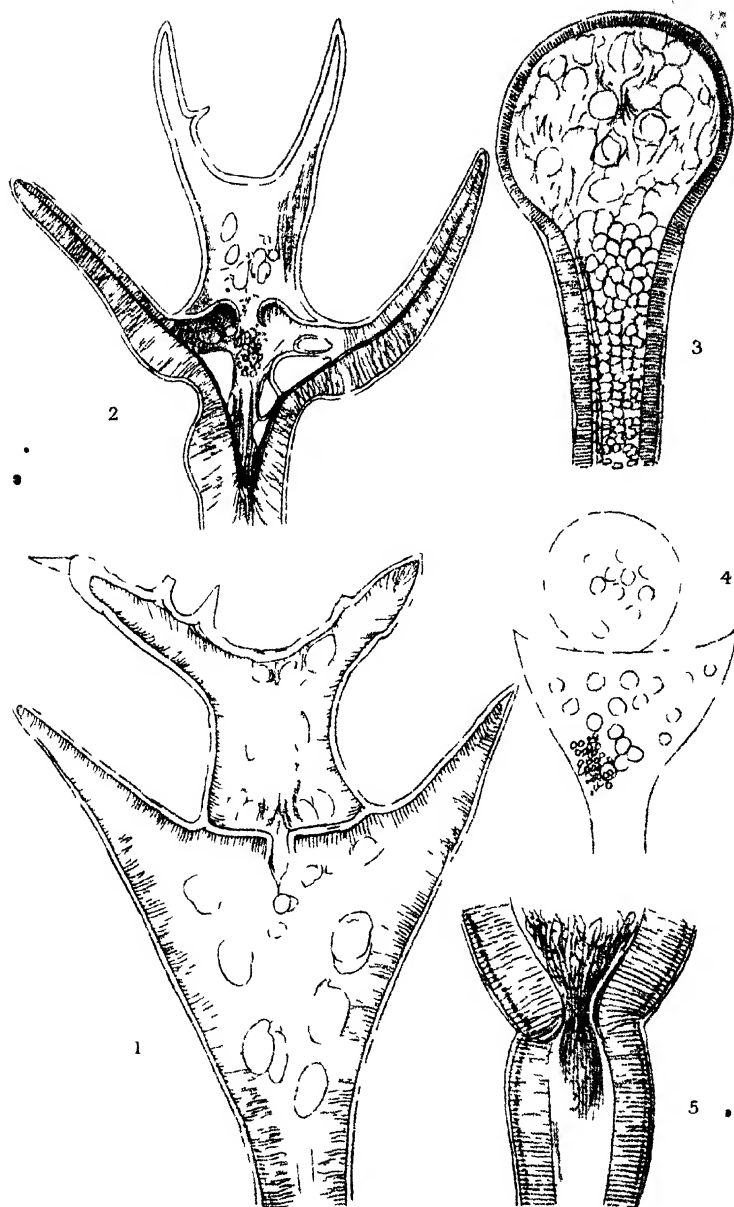
WCM del

Huth lith et imp

1, 2, 4 *Mercierella* 3, 5 *S. vermacularis* 6, 7 *Hydroides norvegica*.





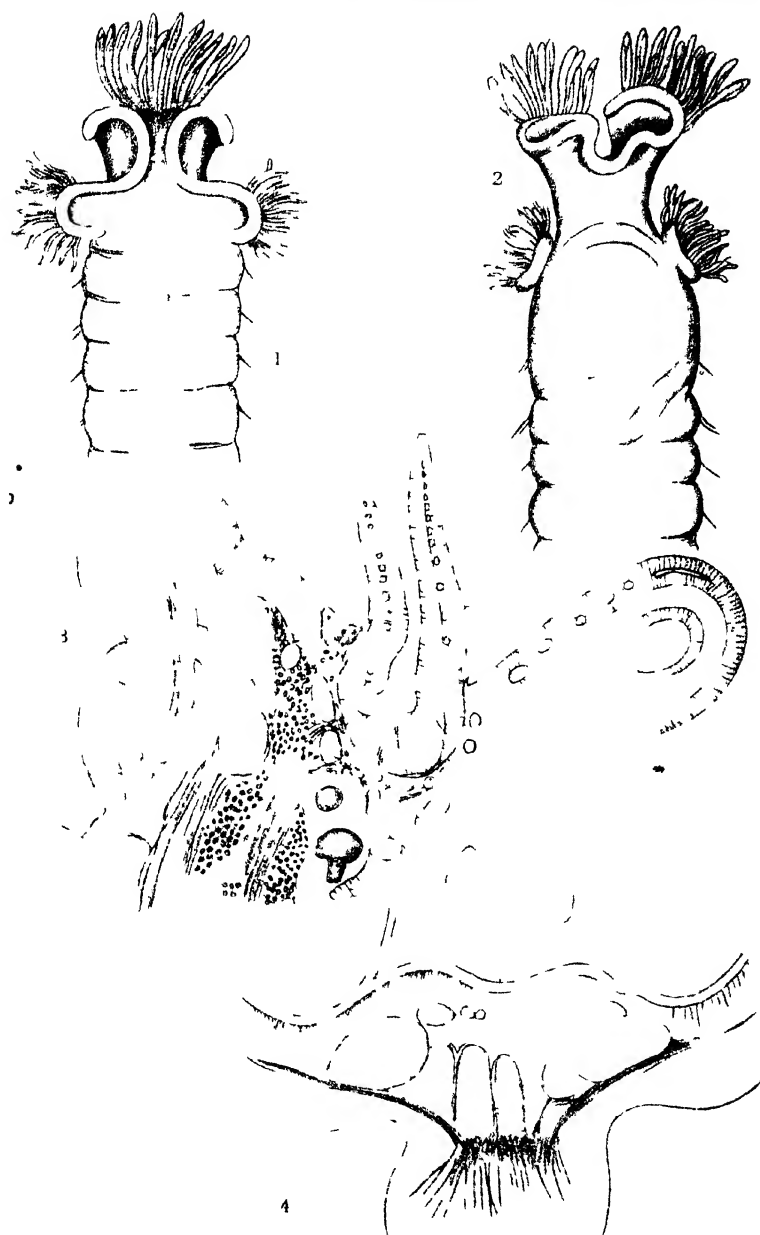


W.C.M. del.

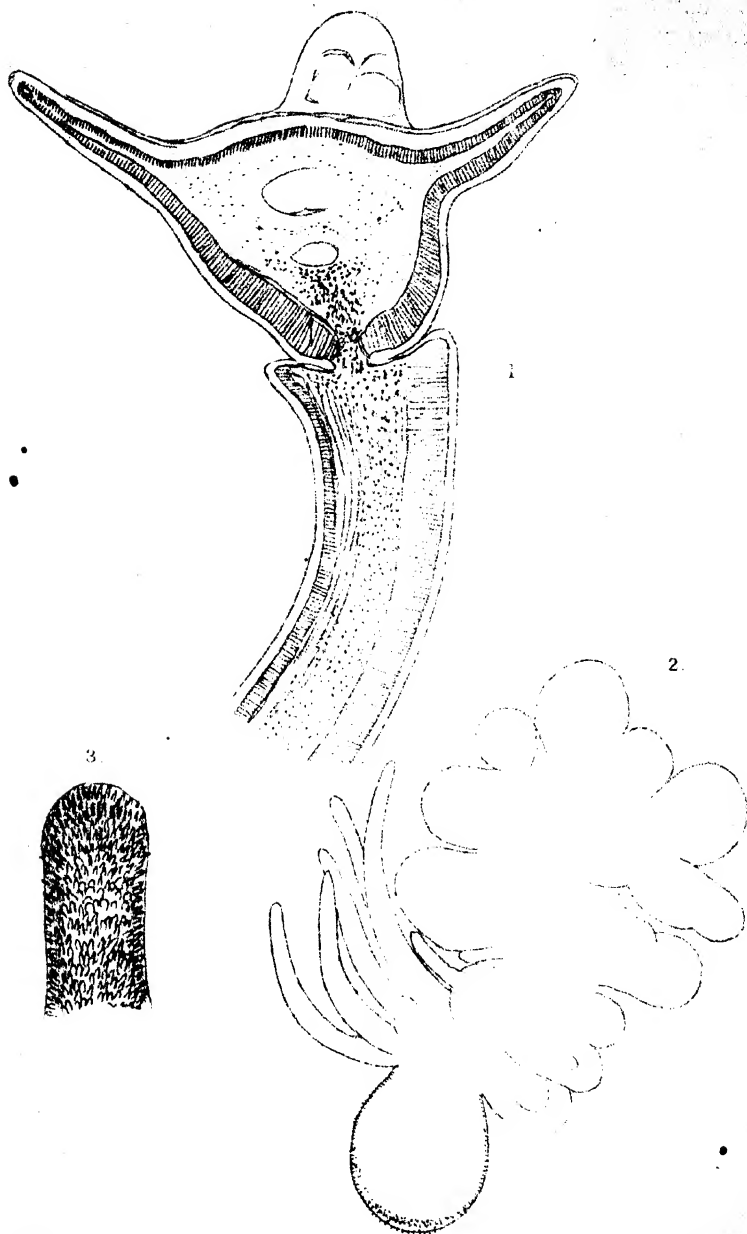
Huth lith. et imp.

1 *Hydroides norvegica* 2 *Hydroides* (?) 3 *Ficopomatus*  
 4 Serpulid from Chilka. 5 *Pomatocerus*







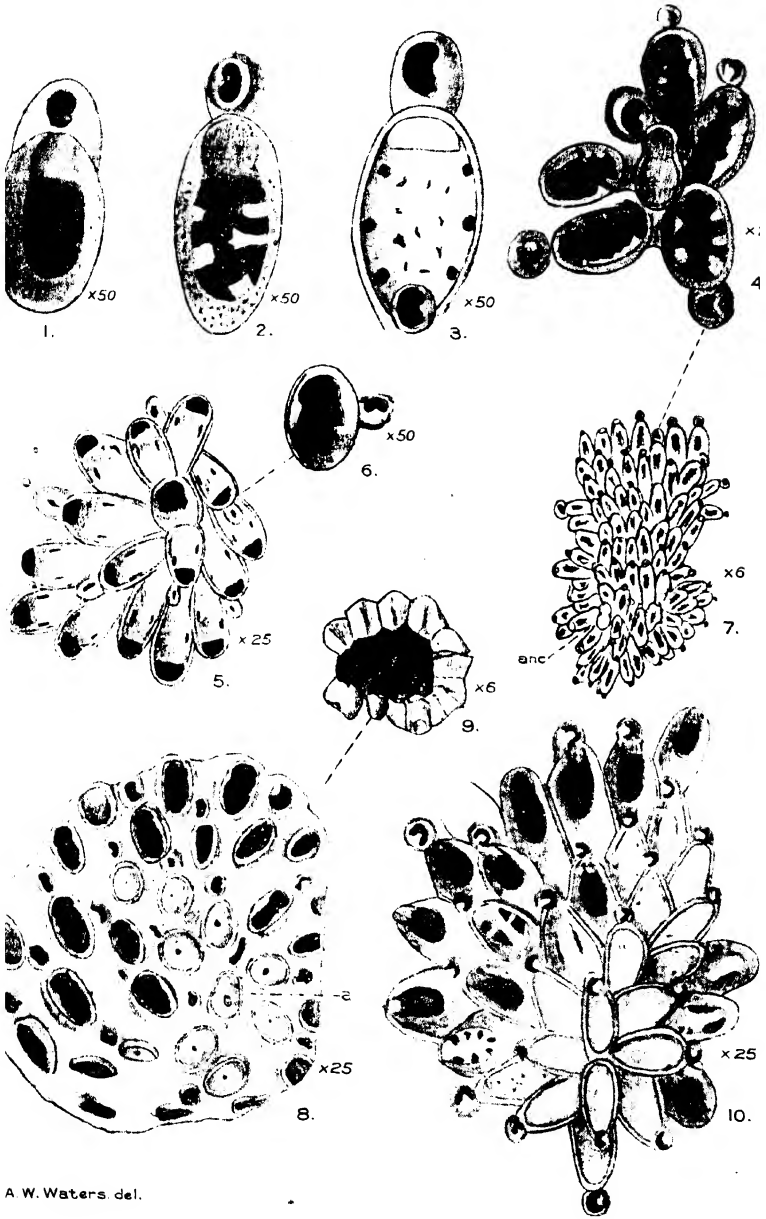


W. C. M. d. s.

Hutch. lith. et imp.

1. *Pomatocerus*. 2, 3. Enigmatical body.





A. W. Waters del.

ANCESTRULA (CUPULARIA).







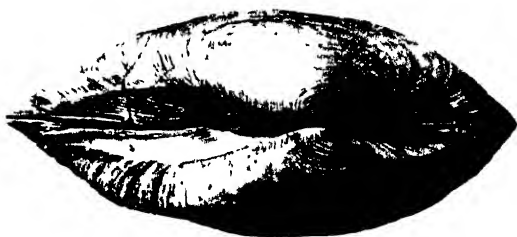
1



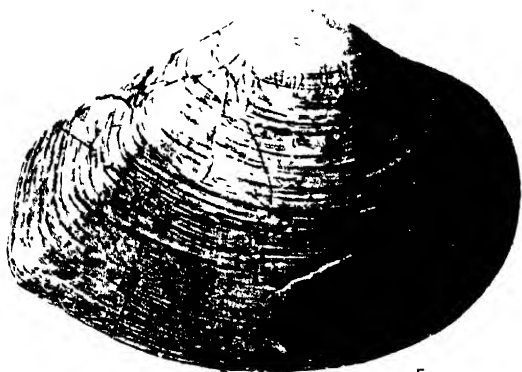
2.



3

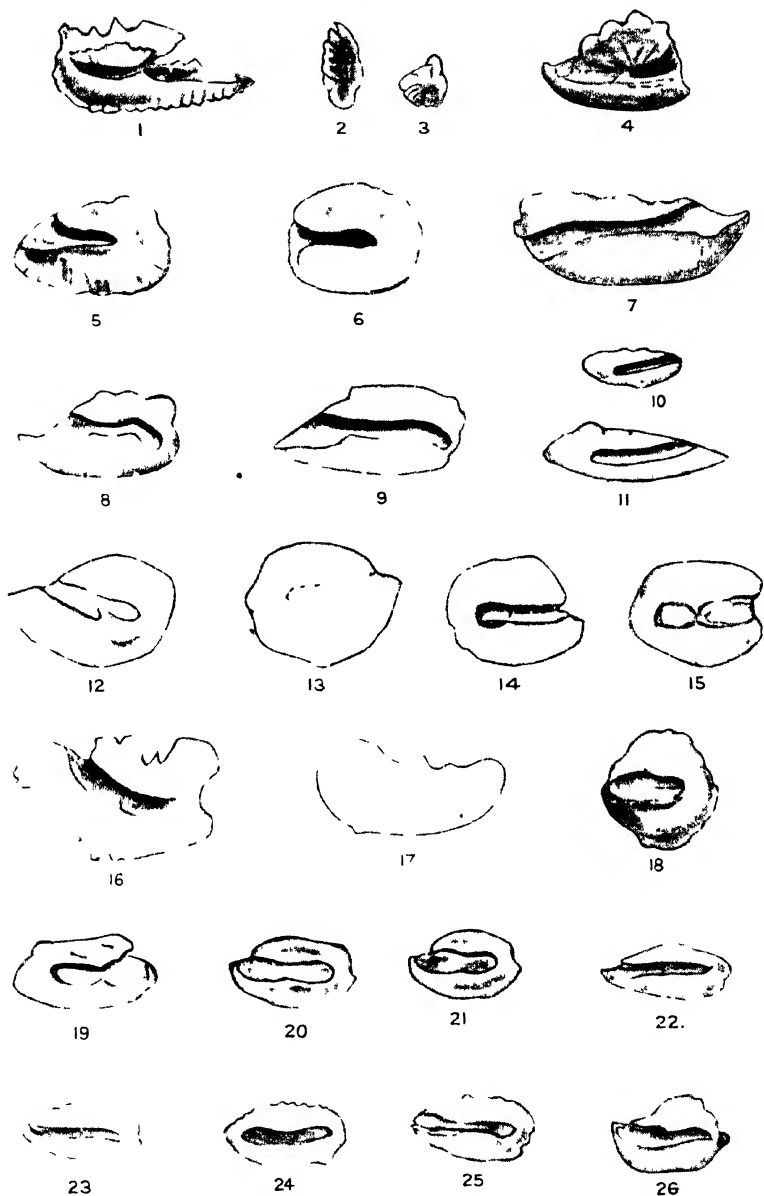


4



5.

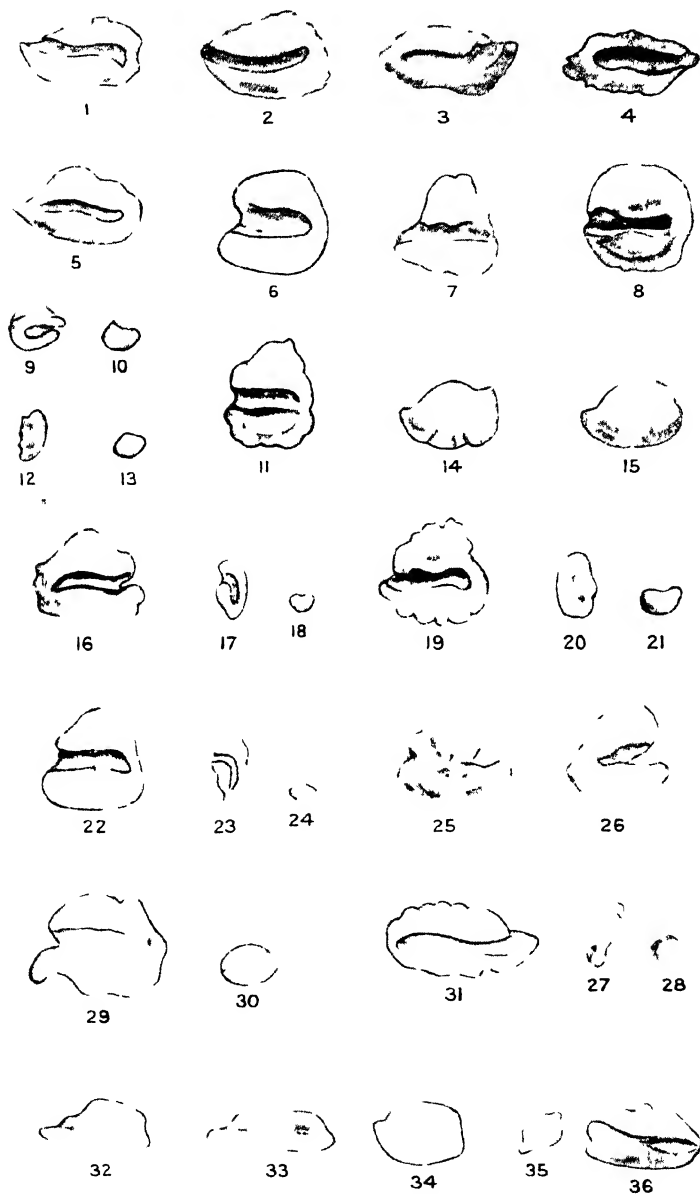




G Allan Frost del

OTOLITHS OF THE ORDERS HAPLOMI, HETEROMI, INIOMI,  
HYPOSTOMIDES, SALMOPERCAE & SYNENTOGNATHI.





G Allan Frost del

OTOLITHS OF THE ORDERS SYNENTOGNATHI,  
MICROCYPRIINI & SOLENICHTHYES





1.



2.



3.



4.



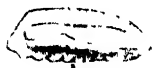
5.



6.



7.



8.



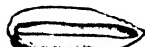
9.



10.



11.



12.



13.



14.



15.



16.



17.



18.



19.



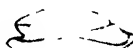
20.



21.



22.



23.



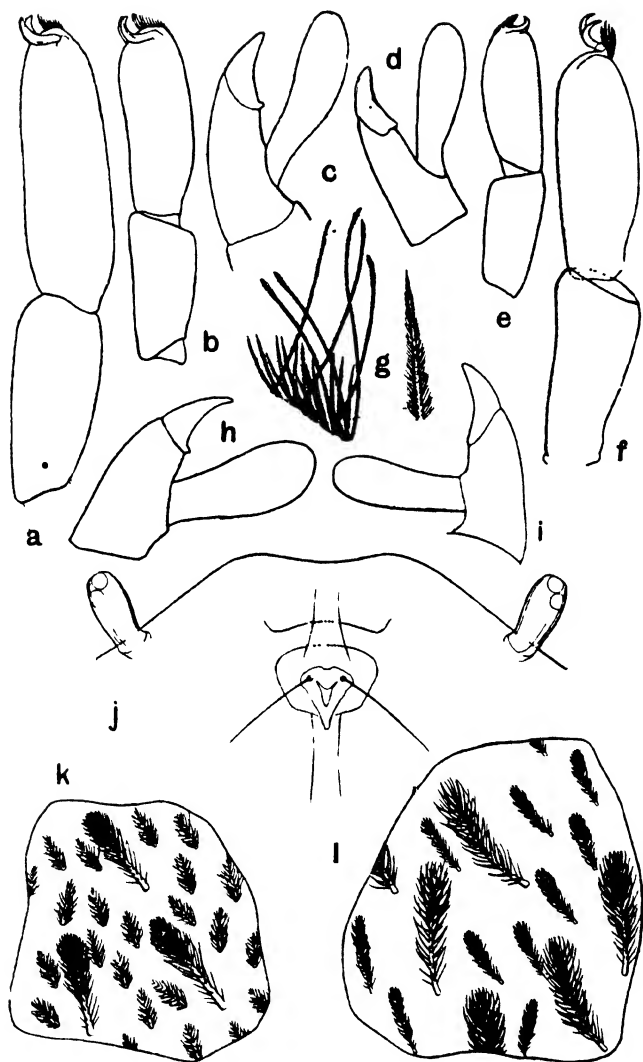
24.

G Allan Frost, del

OTOLITHS OF THE ORDER ANACANTHINI.

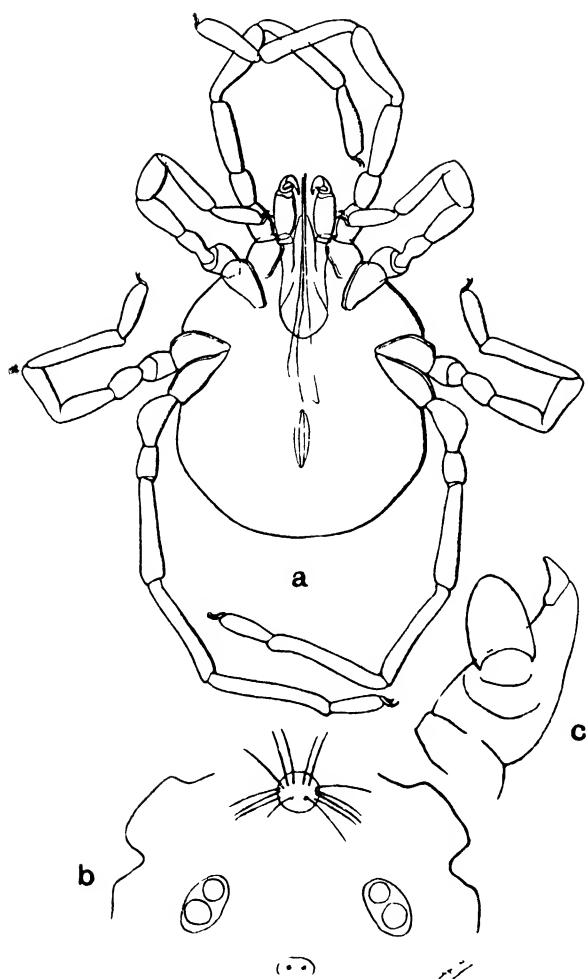






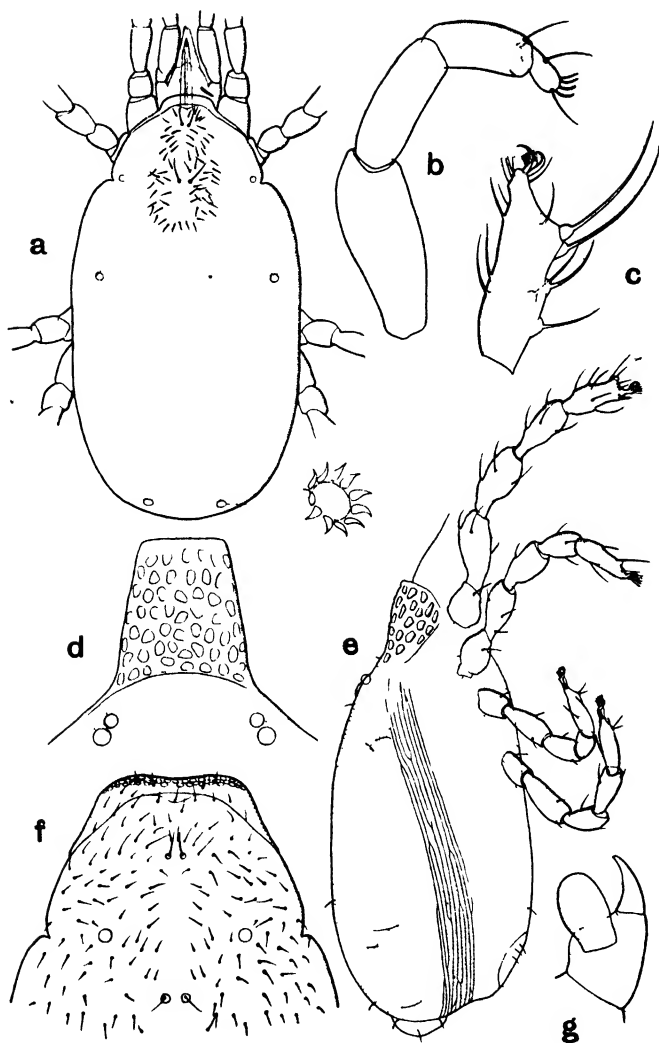
New Mites of the Suborder Prostigmata.





New Mites of the Suborder Prostigmata.





**New Mites of the Suborder Prostigmata.**





1



6



3



7



2



5



4

H G Herring photo

SCALPELLUM (ARCOSCALPELLUM) SANCHEZI n sp





